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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT ADDENDUM SOLID WASTE MANAGEMENT UNIT 161 (SWMU 161) ZONE K NAVAL STATION ANNEX CNC CHARLESTON SC

7/24/2001

CH2M HILL

RFI REPORT ADDENDUM

SWMU 161, Zone K
Naval Station Annex

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

CH2M-Jones

July 2001

Revision 0

Contract N62467-99-C-0960

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July 24, 2001

Mr. David Scaturo
Division of Hazardous and Infectious Wastes
South Carolina Department of Health and
Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: RFI Report Addendum (Revision 0) – SWMU 161, Zone K, Naval Station Annex

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum (Revision 0) – SWMU 161, Zone K, Naval Station Annex of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

Please contact me if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att

RFI REPORT ADDENDUM

SWMU 161, Zone K
Naval Station Annex

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

PREPARED BY
CH2M-Jones

July 2001

Revision 0
Contract N62467-99-C-0960
158814.ZK.PR.03

Certification Page for RFI Report Addendum (Revision 0) – SWMU 161, Zone K, Naval Station Annex

I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

Temporary Permit No. T2000342

Dean Williamson, P.E.

7/24/2001

Date

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E Data Validation Reports from CH2M-Jones sampling subsequent to the *Zone K RFI Report, Revision 0*
F Responses to Comments on the *Draft Zone K RFI Report* (EnSafe, 1997)

Acronyms and Abbreviations

AOC	area of concern
AST	aboveground storage tank
BCT	BRAC Cleanup Team
BRAC	Base Realignment and Closure Act
BRC	background reference concentration
BTEX	benzene, toluene, ethyl benzene, xylene
CA	corrective action
CMS	corrective measures study
CNC	Charleston Naval Complex
COC	chemical of concern
COPC	chemical of potential concern
DAF	dilution attenuation factor
DDE	4,4'-DDE
DDT	4,4'-DDT
DRO	diesel range organic
EnSafe	EnSafe Inc.
EPA	U.S. Environmental Protection Agency
ft bls	foot/feet below land surface
HHRA	human health risk assessment
HI	hazard index
IRIS	Integrated Risk Information System
MCL	maximum contaminant level
µg/kg	microgram per kilogram
µg/L	microgram per liter
mg/kg	milligram per kilogram
MTBE	methyl tert-butyl ether
NAVBASE	Naval Base
NFA	no further action
NFI	no further investigation

1	OWS	oil/water separator
2	OCDD	octachlorodibenzo-p-dioxin
3	PCB	polychlorinated biphenyl
4	pg/L	picograms per liter
5	PRG	preliminary remediation goal
6	RBC	risk-based concentration
7	RCRA	Resource Conservation and Recovery Act
8	RFA	RCRA Facility Assessment
9	RFI	RCRA Facility Investigation
10	SCDHEC	South Carolina Department of Health and Environmental Control
11	SCTL	soil cleanup target level
12	SPLP	synthetic precipitation leaching procedure
13	SSL	soil screening level
14	SVOC	semivolatile organic compound
15	SWMU	solid waste management unit
16	TCE	trichloroethylene
17	TPH	total petroleum hydrocarbon
18	TPHCWG	Total Petroleum Hydrocarbon Criteria Work Group
19	UST	underground storage tank
20	VOC	volatile organic compound

Section 1.0

1.0 Introduction

In 1993, Naval Base (NAVBASE) Charleston was added to the list of bases scheduled for closure as part of the Defense Base Realignment and Closure Act (BRAC), which regulates closure and transition of property to the community. The Charleston Naval Complex (CNC) was formed as a result of the dis-establishment of the Charleston Naval Shipyard and NAVBASE on April 1, 1996.

Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA) with the South Carolina Department of Health and Environmental Control (SCDHEC) as the lead agency for CA activities at the CNC. All RCRA CA activities are performed in accordance with the Final Permit (Permit No. SC0 170 022 560).

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to complete the RCRA Facility Investigation (RFI) for Solid Waste Management Unit (SWMU) 161 in Zone K of the Naval Complex. The site is recommended for No Further Action (NFA). Figure 1-1 illustrates the location of SWMU 161 within Zone K. The insert shows the location of Zone K within the CNC. Figure 1-2 is an infrared photograph of SWMU 161.

1.1 Background

SWMU 161 consists of a gravel parking lot, a vehicle maintenance/wash bay with a grease pit, and Building 2505. The vehicle maintenance/wash bay and grease pit area is equipped with a drainage system and collection sump. The sump contents are pumped into an 800-gallon oil/water separator (OWS). Waste oil from the OWS is stored in a 275-gallon aboveground storage tank (AST). The *RCRA Facility Assessment Naval Base Charleston* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995) reported that water from the OWS was discharged into the Naval Annex storm sewer system. The *Zone K RFI Report, Revision 0* (EnSafe, 1999a), concluded that water from the OWS was discharged into the sanitary sewer. The facility has been used in its current capacity since the Navy took possession of the building from the Air Force in 1981. Although operational records during the Air Force's ownership are not available, it is likely that the Air Force used the facility in a manner similar to how the Navy has used it.

No significant documented spills or releases are known to have occurred at SWMU 161. However, visual evidence of minor spills, likely the result of routine vehicle maintenance activities, were noted during the RCRA Facility Assessment (RFA) site visit made by EnSafe in 1995. Several small oil stains were noted in the contained portion of the wash bay area.

Chemicals associated with motor vehicle maintenance consist of petroleum products such as motor and lubricating oils, solvents, and antifreeze. Materials of concern identified in the *Final Zone K RFI Work Plan Addendum* (EnSafe, 1999b) were solvents, metals, and petroleum products.

1.2 Purpose of the RFI Report Addendum

This RFI Report Addendum provides information about SWMU 161 that documents the conclusions from the *Zone K RFI Report, Revision 0*, provides the results of some limited additional sampling performed after the RFI, and supports a recommendation of NFA for SWMU 161.

Prior to changing the status of any site to NFA in the CNC RCRA CA permit, the BRAC Cleanup Team (BCT) agreed that the following issues should be considered:

- Status of the RFI
- Presence of metals (inorganics) in groundwater
- Potential linkage to SWMU 37, Investigated Sanitary Sewers at the CNC
- Potential linkage to Area of Concern (AOC) 699, Investigated Storm Sewers at the CNC
- Potential linkage of AOC 504, Investigated Railroad Lines at the CNC
- Potential linkage to surface water bodies (Zone J)
- Potential contamination associated with OWSs
- Relevance or need for land use controls at the site

Information regarding these issues is provided in this RFI Report Addendum to expedite evaluation of closure of the site.

Provided that the information presented in this report adequately addresses these site closeout items, it is expected that the BCT will concur that NFA is appropriate. At that time, a Statement of Basis will be prepared that will be made available for public comment, in accordance with SCDHEC policy. This will allow for public participation in the final remedy selection.

1.3 Report Organization

This RFI Report Addendum consists of the following sections, including this introductory section:

1.0 Introduction — Presents the purpose of the report and background information relating to the RFI Report Addendum.

2.0 Summary of RFI Conclusions for SWMU 161 — Summarizes the conclusions from the RFI investigations and risk evaluations for SWMU 161.

3.0 Interim Measures and UST/AST Removals — Summarizes any interim measures conducted at the site and/or underground storage tank (UST) and AST removal from the site.

4.0 Summary of Additional Investigations — Summarizes information collected after completion of the RFI report.

5.0 COPC/COC Refinement — Provides further evaluation of chemicals of potential concern (COPCs) based on RFI and additional data to assess them as chemicals of concern (COCs).

6.0 Summary of Information Related to Site Closeout Issues—Discusses the various site closeout issues that the BCT agreed to evaluate prior to site closeout.

7.0 Recommendations—Provides recommendations for proceeding with site closure.

8.0 References — Lists the references used in this document.

Appendix A contains Figure 2.7, *Shallow Groundwater Potentiometric Contours*.

Appendix B contains EnSafe's analytical data from sampling conducted subsequent to the RFI report.

Appendix C contains EnSafe's data validation reports from sampling conducted subsequent to the RFI report.

Appendix D contains analytical data from CH2M-Jones' sampling conducted subsequent to theRFI report.

Appendix E contains data validation reports from CH2M-Jones' sampling conducted subsequent to the RFI report.

Appendix F contains Ensafe's responses to comments regarding SWMU 161 from the *Draft Zone K RFI Report*, dated December 10, 1997.

All tables and figures appear at the end of their respective sections.

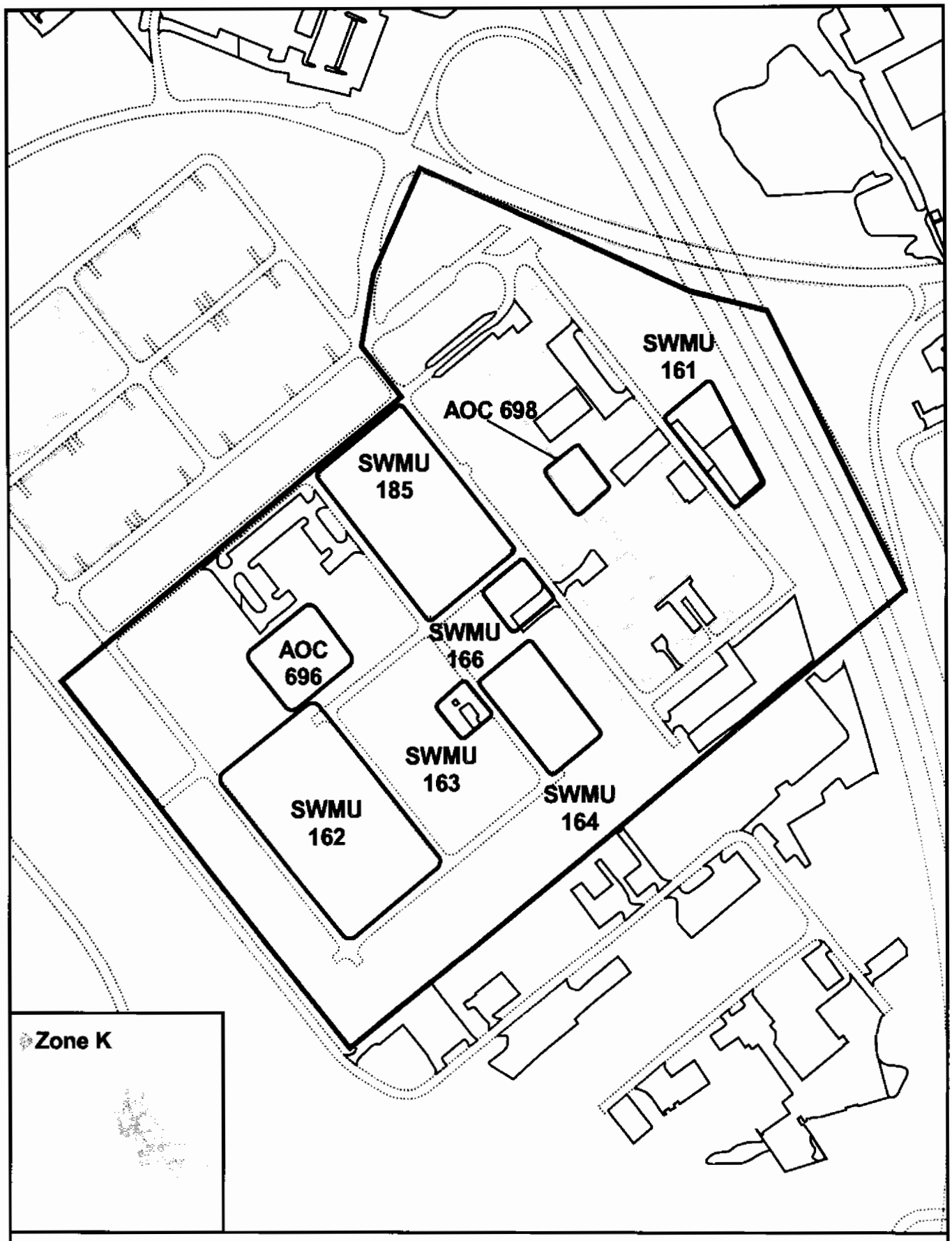

Figure 1-1
Location of SWMU 161
Zone K
Charleston Naval Complex

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AOC Boundary
SWMU Boundary
Roads
Buildings
Zone Boundary

N

0 100 200 Feet

Original figure was produced in color.

Figure 1-2
Infrared Photograph of SWMU 161
Zone K
Charleston Naval Complex

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Section 2.0

2.0 Summary of RFI Conclusions for SWMU 161

As part of the Zone K RFI, soil and groundwater investigations were conducted in the vehicle maintenance shop area of SWMU 161. Figure 2-1 illustrates the site and RFI soil sample locations. Figure 2-1 also indicates the locations of samples collected subsequent to the RFI. Figure 2-2 illustrates the location of the monitor well used for evaluating SWMU 161. Eight soil borings (K161SB001 through K162SB008) were advanced at SWMU 161 as part of the RFI to determine if site activities impacted the site soil. A surface and subsurface sample was collected from each boring. Five groundwater sampling events were conducted at SWMU 161. The *Zone K RFI Report, Revision 0* (EnSafe, 1999a) presented the analytical results of these samples and conclusions concerning contamination and risk. Conclusions from the RFI report regarding site soil are summarized below.

2.1 Soil

Results of surface soil analyses were compared in the *Zone K RFI Report, Revision 0* to applicable screening criteria (U.S. Environmental Protection Agency [EPA] Region III residential risk-based concentrations [RBCs], EPA soil screening levels [SSLs], dilution attenuation factor [DAF]=10, and the Zone K background reference concentrations [BRCs]).

Analytes that exceeded the screening criteria were considered to be COPCs and were further evaluated in the risk assessment to determine which of these parameters were considered to be COCs.

2.1.1 Surface Soil

Section 10.1.2 of the *Zone K RFI Report, Revision 0,* which describes the nature and extent of contamination, concluded that:

- No volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), or polychlorinated biphenyls (PCBs) were detected in surface soil samples collected at SWMU 161.
- No inorganic constituents were detected in surface soil samples above their respective RBCs, SSLs, or BRCs.
- Two pesticides, 4,4'-DDE (DDE) and 4,4'-DDT (DDT), were reported to be present in surface soil samples, but at concentrations below their RBC screening concentrations

(1,900 micrograms per kilogram [µg/kg] for DDE, and 1,900 µg/kg for DDT [hazard index] HI=1). DDE was detected in soil borings K161SB005 at 4.3 µg/kg, K161SB006 at 6.83 µg/kg, and K161SB008 at 5.51 µg/kg. DDT was detected in soil borings K161SB006 and K161SB008 at concentrations of 10.8 µg/kg and 13.5 µg/kg, respectively.

- Dioxins were reported in the duplicate sample collected at K161SB002 with a calculated TEQ several orders of magnitude below the SSL.
- Total petroleum hydrocarbons (TPH) and diesel range organics (DROs) were detected in two of eight surface soil samples (K161SB006 at 11.8 milligrams per kilogram [mg/kg] and K161SB007 at 314 mg/kg). Sample K161SB00701 exceeded the CNC TPH screening level of 100 mg/kg.

The fate and transport section, Section 10.1.5, concluded that no organic or inorganic constituents were detected in site surface soil above applicable SSLs. Therefore, the surface soil-to-groundwater pathway was considered invalid.

The human health risk assessment (HHRA) section, Section 10.1.6, concluded that no COPCs were identified in surface soil samples collected at SWMU 161. However, diesel-range TPH was detected at a concentration exceeding 100 mg/kg in one surface soil sample collected at SWMU 161 (161SB007).

2.1.2 Subsurface Soil

The screening criteria for subsurface soils were SSLs (DAF=10) and, for organics, Zone K BRCs. Section 10.1.2 of the *Zone K RFI Report, Revision 0*, which describes the nature and extent of contamination, concluded the following:

- No VOCs exceeded applicable SSLs.
- One SVOC, di-n-butylphthalate, was detected in subsurface sample K161SB00502 at a concentration of 100 µg/kg, which is below its SSL of 2,300,000 µg/kg.
- No pesticides were detected in subsurface soil samples collected at SWMU 161, nor were inorganic constituents detected above their respective SSLs and BRCs.
- TPH-DROs were detected in two of eight subsurface samples (K161SB00502 at 8.3 mg/kg and K161SB00602 at 11 mg/kg), both of which were below the CNC TPH-DRO screening level of 100 mg/kg.

The fate and transport section, Section 10.1.5, concluded that no subsurface soil sample reported concentrations of constituents above their respective SSLs. Therefore, the subsurface soil-to-groundwater pathway was considered invalid.

The HHRA section, Section 10.1.6, did not identify any COPCs in subsurface soil at SWMU 161.

2.2 Groundwater

Groundwater was also investigated at this site during the original RFI. Figure 2-2 illustrates the location of the monitor well (K161GW001) that was used in the investigation of SWMU 161. The shallow groundwater flow direction is generally to the east at SWMU 161, based on water level measurements obtained during the RFI. Figure 2.7 of the *Zone K RFI Report, Revision 0*, provided as Appendix A of this RFI Report Addendum, illustrates the shallow groundwater potentiometric contours based on the water level measurements.

Results of groundwater analyses were compared in *Zone K RFI Report, Revision 0* to BRCs and tap water RBCs as screening criteria.

Analytes that exceeded the screening criteria were considered COPCs and were further evaluated in the risk assessment to determine which of the parameters were considered COCs.

The *Zone K RFI Report, Revision 0* presented the analytical results of five groundwater samples collected from monitor well K161GW001. The analytical results of these samples are discussed in the *Zone K RFI Report, Revision 0*, and the conclusions regarding site groundwater are summarized below.

The nature and extent of contamination section, Section 10.1.4, reported the following conclusions:

- No VOCs, SVOCs, PCBs, TPH, herbicides, or pesticides were detected in SWMU 161 groundwater samples.
- One dioxin congener, octachlorodibenzo-p-dioxin (OCDD), was detected at a concentration of 6.9 picograms per liter (pg/L) in the first sample collected at K161GW001, which is below its RBC of 450 pg/L, but was not detected in subsequent samples.
- No inorganic constituent was detected in groundwater samples above its RBC or BRC.

Section 10.1.5, the fate and transport section, concluded that "no organics or inorganics in SWMU 161 groundwater exceeded risk-based drinking water concentrations. As a result, this pathway is not considered valid at SWMU 161."

The HHRA section, Section 10.1.6, concluded that no COCs were present in groundwater samples collected at SWMU 161.

2.3 COPC/COC Summary

The *Zone K RFI Report, Revision 0* concluded that, based on the analytical results and the HHRA, no COCs were identified that require further investigation through the corrective measures study (CMS) process, and the site was recommended for NFA.

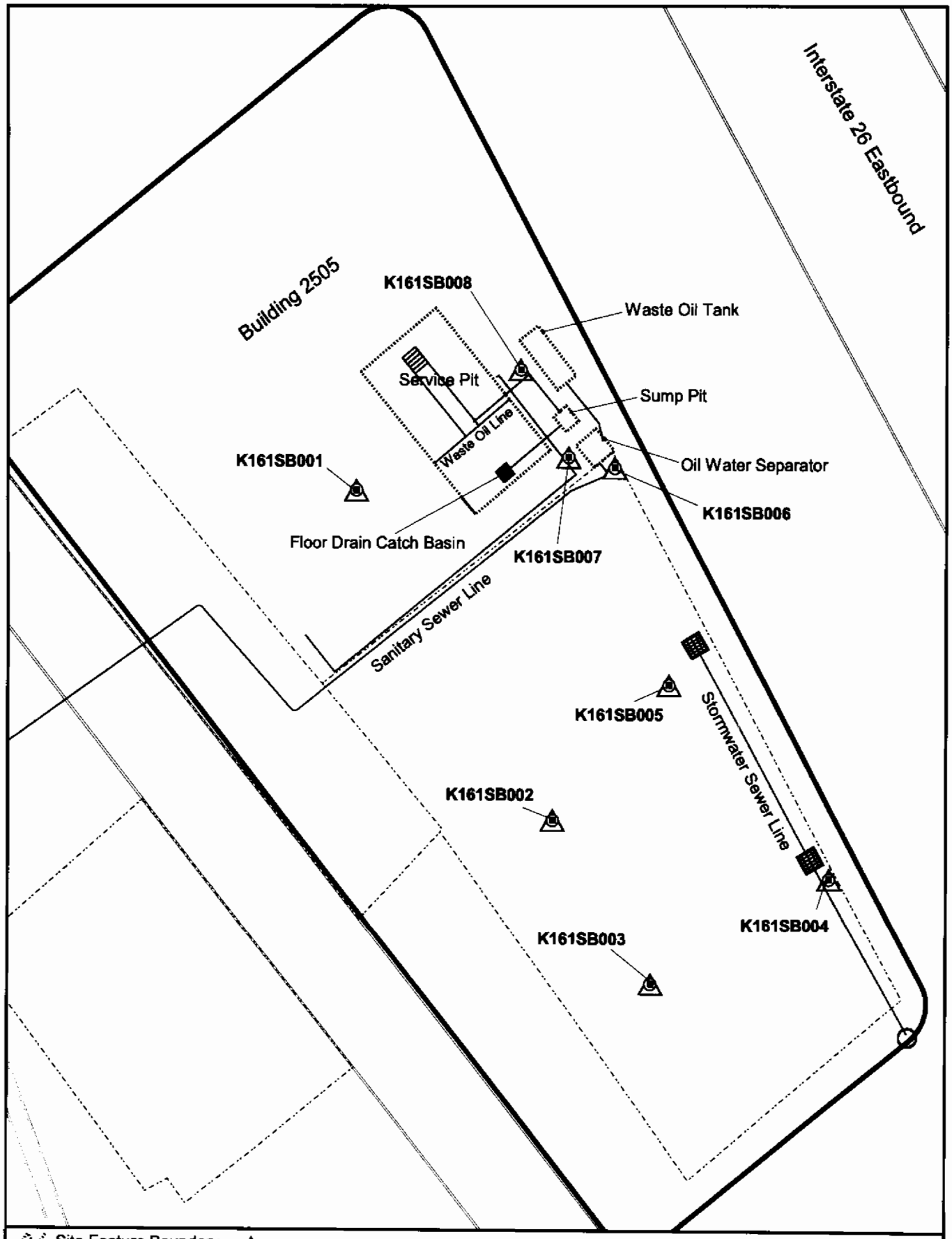

Figure 2-1
Soil Sample Locations
SWMU 161, Zone K
Charleston Naval Complex

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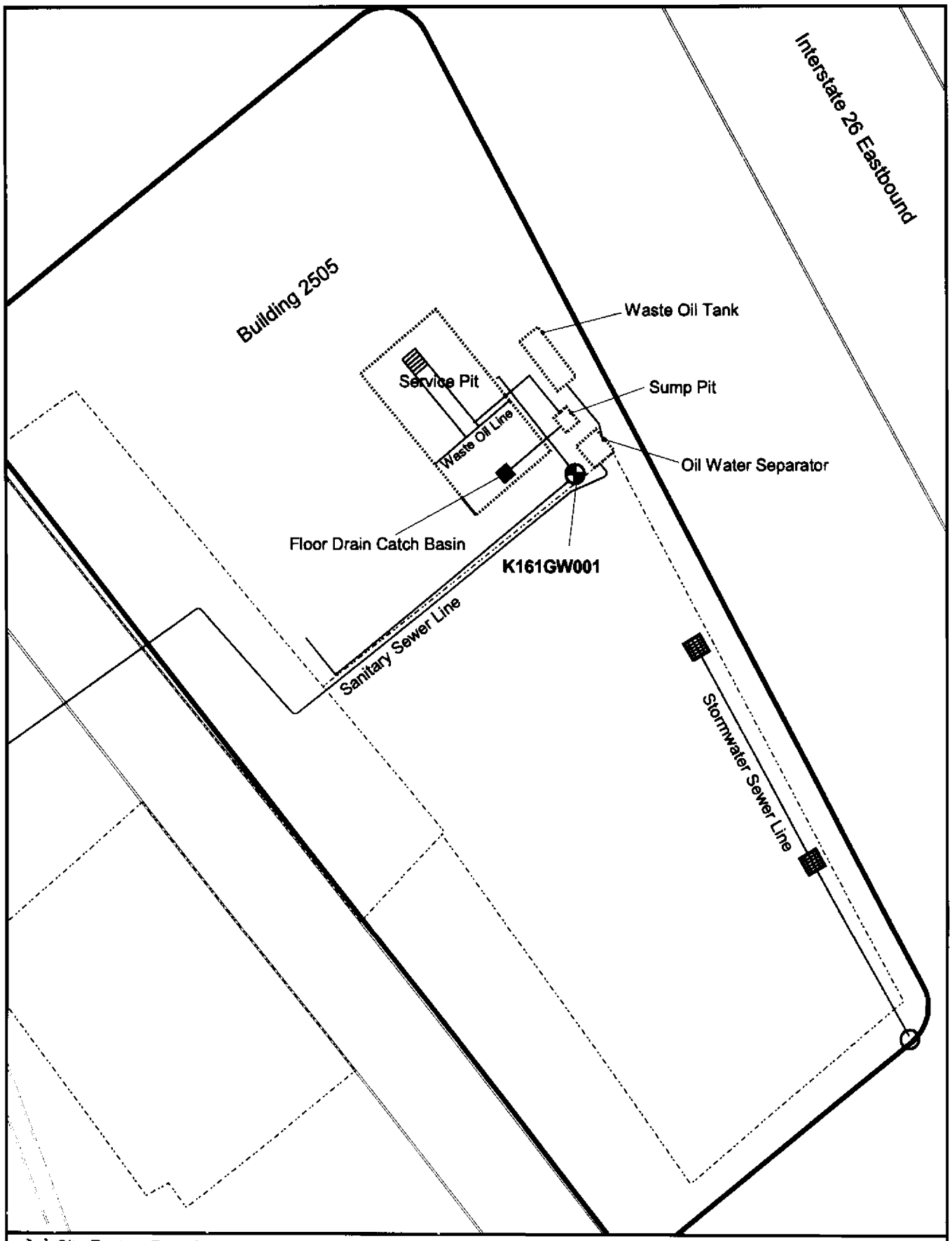

Figure 2-2
Groundwater Well Location
SWMU 161, Zone K
Charleston Naval Complex

CH2MHILL

Section 3.0

3.0 Interim Measures and UST/AST Removals

No interim measures have been performed at SWMU 161. In addition, no USTs or ASTs are known to have been located at or removed from SWMU 161.

Section 4.0

4.0 Summary of Additional Investigations

During the latter part of 1999, additional field activities were conducted by EnSafe subsequent to the *Zone K RFI Report, Revision 0* (EnSafe, 1999a) in general accordance with the *Zone K RFI Work Plan Addendum* (EnSafe, 1999b). Additional soil samples (K161SB004S and K161SB008S) were collected to determine synthetic precipitation leaching procedure (SPLP) ratios. From these results, site-specific SSL values could be calculated. These samples were also analyzed for VOCs (K161SB004T) and total metals (K161SB008T). The new sample locations were co-located with previously collected RFI samples (K161SB004 and K162SB008).

Additional field activities were conducted to verify that the OWS had not impacted site soil. Five soil borings (K161SB009 through K161SB013) were installed. A surface (0-1 foot below land surface [ft bls]) and subsurface (3-5 ft bls) sample was collected from each boring and analyzed for VOCs. Samples collected at soil boring locations K161SB012 and K161SB013 were also analyzed for dioxins. The boring locations are illustrated on Figure 4-1. The data from the additional investigations are summarized in this section; analytical data results and data validation summary reports are provided as Appendices B and C, respectively.

An additional groundwater sample was collected from the existing monitor well at SWMU 161 after the completion of the RFI. The sample was collected and analyzed for VOCs and dioxins in December 1999.

CH2M-Jones recommended collecting vertical profile samples at three locations identified as 161VP001 through 161VP003, in addition to the field activities completed by EnSafe (CH2M-Jones, 2000). These samples have been collected and are also discussed in this section. Analytical data results and validation reports for the vertical profile samples are provided in Appendices D and E, respectively.

4.1 Soil Sampling Results – EnSafe RFI Addendum

Analytical results from the additional samples were compared to the appropriate screening criteria. Surface soil results were compared to the EPA Region III RBCs, SSLs (DAF=1 for VOCs; DAF=10 for other parameters), and BRCs. When both the BRC and either the RBC or SSL were exceeded, the chemical was selected as a COPC. Subsurface soil results were

compared to BRCs and SSLs (the same DAF as for surface soil). When both were exceeded, the chemical was selected as a COPC for the soil-to-groundwater leachability pathway. Tables 4-1 and 4-2 present the analytical result summaries of the additional samples for surface and subsurface soils, respectively. Analytical results that exceeded the appropriate screening criteria are in bolded text within the tables.

4.1.1 Surface Soil

Comparison of the additional surface soil data to the appropriate screening criteria indicated that no inorganic constituents were detected at concentrations that exceeded both their RBCs and BRCs.

One VOC, 2-hexanone, was detected at a concentration below its RBC of 3,000 mg/kg (HI=1) in one surface soil sample (K161SB01301a at 0.00565 mg/kg). The reported concentration is estimated and near the detection limit, as indicated by the "J" qualifier.

Samples K161SB01201 and K161SB01301 were analyzed for dioxins. No dioxin congeners were detected that exceeded their respective screening criteria, nor did the calculated TEQ values exceed its screening criteria.

Evaluation of the data from samples collected after completion of the RFI did not identify COPCs in SWMU 161 surface soil. A summary of surface soil data collected during EnSafe's additional fieldwork is presented in Table 4-1.

4.1.2 Subsurface Soil

Comparison of the additional subsurface soil data to the screening criteria indicated that no constituents were identified as exceeding their respective screening criteria. Several naturally occurring metals, such as arsenic, barium, copper, lead, and nickel, were reported above their respective BRCs; however, none were reported above their SSLs. No organic compounds were detected above their SSLs.

Evaluation of the data from samples collected after completion of the RFI did not identify COPCs in SWMU 161 subsurface soil. A summary of subsurface soil data collected during EnSafe's additional fieldwork is presented in Table 4-2.

4.2 Groundwater Results

One additional groundwater sampling event was conducted by EnSafe at monitor well K161GW001 as part of the SWMU 161 investigation in December 1999. The sample was analyzed for dioxins and VOCs. This monitor well was also sampled in July 2000 as part of

the SWMU 166 investigation and was analyzed for VOCs. These groundwater analytical results were compared to maximum contaminant levels (MCLs). In the absence of MCLs, the tap water RBC was used.

No VOCs or dioxins were detected in the samples collected subsequent to the *Zone K RFI Report, Revision 0.*

The groundwater data from the samples collected after completion of the RFI concur with the conclusion that no COCs are present in SWMU 161 groundwater.

4.3 Shallow Groundwater Quality Assessment – CH2M-Jones

In accordance with the CH2M-Jones *RFI Work Plan Addendum* (2000), shallow groundwater at three locations was sampled using the vertical profile method. Groundwater samples were collected at five discrete depths and analyzed for VOCs. Figure 4-2 illustrates the locations of the vertical profile samples. Sample locations K161VP001 and K161VP003 were sampled at 5, 10, 15, 20, and 25 ft bls; sample location K161VP002 was sampled at 4.5, 10, 15, 20, and 25 ft bls. The analytical results were compared to MCLs. In the absence of MCLs, the tap water RBC was used. Table 4-3 summarizes the analytical results for the vertical profile samples for detected compounds. Results that exceeded the appropriate screening criteria appear in bolded text within the tables.

Comparison of the additional groundwater data to the screening criteria indicated that the chlorinated solvents trichloroethylene (TCE) and vinyl chloride exceeded their respective screening criteria. TCE exceeded its MCL of 5 micrograms per liter (µg/L) in 14 of the 15 samples collected at SWMU 161. Vinyl chloride exceeded its MCL of 2 µg/L in one sample (161VP002045 at 3.6 J µg/L). These constituents are likely related to SWMU 166 activities, and their presence in groundwater at this location will be addressed in the SWMU 166 investigation. Therefore, these constituents are not considered COPCs at SWMU 161. Benzene, toluene, ethylbenzene, and xylene (BTEX) compounds were not detected at concentrations above their respective MCLs or RBCs. Based on this information, the vertical profile samples did not identify constituents requiring further consideration as part of the SWMU 161 investigation.

4.4 COPC Evaluation

Surface soil, subsurface soil, and groundwater samples collected after completion of the RFI containing constituent concentrations that exceeded their respective screening criteria are discussed below.

4.4.1 Surface Soil

Evaluation of the data from samples collected after completion of the RFI did not identify COPCs in SWMU 161 surface soil.

4.4.2 Subsurface Soil

Evaluation of the data from samples collected after completion of the RFI did not identify COPCs in SWMU 161 subsurface soil.

4.4.3 Groundwater

TCE and vinyl chloride were detected above their screening criteria in the vertical profile samples collected at SWMU 161. These compounds are likely related to release(s) associated with SWMU 166 activities and are being investigated as part of that investigation. The presence of TCE and vinyl chloride will be addressed in the SWMU 166 investigation. No other compounds were identified in samples collected after completion of the RFI that exceeded their respective screening criteria. Therefore, evaluation of the data from samples collected after completion of the RFI did not identify any COPCs in groundwater that are related to activities at SWMU 161.

TABLE 4-1
Data for Detected Compounds in Surface Soil
RFI Report Addendum, SWMU 161, Zone K, CNC

Parameter	Station ID	Concentration	Units	Qualifier	RBC (HI 0.1)	SSL (DAF=10)*	BRC
VOCs							
2-Hexanone	K161SB013	0.0056	ng/kg	J	310	0.381	NA
Dioxins							
1,2,3,4,6,7,8-Heptachlorodibenzofuran	K161SB012	3.048	ng/kg	=	430	430	NA
	K161SB013	2.636					
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	K161SB012	8.587	ng/kg	=	430	430	NA
	K161SB013	9.573		J			
1,2,3,4,7,8-Hexachlorodibenzofuran	K161SB012	0.727	ng/kg	J	43	43	NA
	K161SB013	0.655		J			
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	K161SB012	0.824	ng/kg	J	4.3	4.3	NA
Octachlorodibenzofuran	K161SB012	9.747	ng/kg	=	4,300	4,300	NA
	K161SB013	8.802		=			
Octachlorodibenzo-p-Dioxin	K161SB012	284.736	ng/kg	=	4,300	4,300	NA
	K161SB013	360.697		=			
Total Hepta-Dioxins	K161SB012	17.911	ng/kg	=	NA	NA	NA
Total Hepta-Furans	K161SB012	3.048	ng/kg	=	NA	NA	NA
	K161SB013	2.636		=			

TABLE 4-1
Data for Detected Compounds in Surface Soil
RFI Report Addendum, SWMU 161, Zone K, CNC

Parameter	Station ID	Concentration	Units	Qualifier	RBC (HI 0.1)	SSL (DAF=10)*	BRC
Dioxins							
Total Hexa-Furans	K161SB012	1.157	ng/kg	=	NA	NA	NA
	K161SB013	1.824		=			
Total Penta-Furans	K161SB013	1.345	ng/kg	=	NA	NA	NA
TEQ	K161SB012	1.3	ng/kg	J	4.3	4.3	NA
	K161SB013	0.56		J			
Metals							
Aluminum	K161SB008	6020	mg/kg	=	7,800	555,000	11200
Arsenic	K161SB008	2.50	mg/kg	=	0.43	14.5	3.0
Barium	K161SB008	8.90	mg/kg	=	550	1,050	25.6
Beryllium	K161SB008	0.03	mg/kg	J	16	600	0.17
Cadmium	K161SB008	0.14	mg/kg	J	7.8	27.5	0.13
Calcium	K161SB008	88100	mg/kg	J	EN/NA	EN/NA	EN/NA
Chromium, Total[vi]	K161SB008	7.20	mg/kg	=	23	21	8.4
Cobalt	K161SB008	1.00	mg/kg	J	470	994	0.34
Copper	K161SB008	1.70	mg/kg	J	310	5,500	3.86
Iron	K161SB008	2950	mg/kg	=	2,300	NA	7,060
Lead[a]	K161SB008	22.9	mg/kg	=	400	400	39.6
Magnesium	K161SB008	1540	mg/kg	=	EN/NA	NA	EN/NA
Manganese	K161SB008	78.2	mg/kg	=	160	475	26.4
Mercury	K161SB008	0.030	mg/kg	=	2.3	1.04	NC
Nickel	K161SB008	4.30	mg/kg	J	160	50	1.7
Potassium	K161SB008	305.0	mg/kg	=	EN/NA	NA	EN/NA

TABLE 4-1
Data for Detected Compounds in Surface Soil
RFI Report Addendum, SWMU 161, Zone K, CNC

Parameter	Station ID	Concentration	Units	Qualifier	RBC (HI 0.1)	SSL (DAF=10)*	BRC
Metals							
Sodium	K161SB008	69.2	mg/kg	=	EN/NA	NA	EN/NA
Vanadium	K161SB008	8.20	mg/kg	=	510	275	15.8
Zinc	K161SB008	47.9	mg/kg	J	2,300	7,000	14.8

Bold values are exceedances of both the RBCs and background values or cleanup goals.

Screening criteria are listed for detected constituents.

* SSLs are based on a DAF of 10 except for VOCs, which are based on a DAF of 1.

= Analyte was detected, the reported value is equal to the sample concentration.

[a] SSL and RBC for lead are equal to the screening level established by the U.S. EPA (Soil Screening Guidance, 1996)

[VI] SSL and RBC are based on values for Cr+6.

EN Compound is an essential nutrient.

J Analyte was detected; the reported value is an estimated concentration.

mg/kg milligram per kilogram

NA Information is not available or not applicable.

NC BRC was not calculated due to a large number of non-detects (>90%).

ng/kg nanogram per kilogram

U Analyte was not detected; the reported value is the detection limit.

UJ Analyte was not detected; the reported value is an estimated detection limit.

TABLE 4-2
Data for Compounds Detected in Subsurface Soil
RFI Report Addendum, SWMU 161, Zone K, CNC

Parameter	Station ID	Concentration	Units	Qualifier	SSL (DAF=10)	BRC
Dioxins						
Octachlorodibenzo-p-Dioxin	K161SB012	68.940	ng/kg	=	4,300	NA
	K161SB013	27.402		=		
TEQ	K161SB012	0.069	ng/kg	J	4.3	NA
	K161SB013	0.027		J		
Metals						
Aluminum	K161SB008	6470	mg/kg	=	555,000	10,500
Arsenic	K161SB008	2.20	mg/kg	=	14.5	2.0
Barium	K161SB008	9.90	mg/kg	=	1,050	6.83
Calcium	K161SB008	31,000	mg/kg	J	EN/NA	EN/NA
Chromium, Total[vi]	K161SB008	6.80	mg/kg	=	21	8.76
Cobalt	K161SB008	0.59	mg/kg	J	994	0.62
Copper	K161SB008	5.50	mg/kg	=	5,500	0.34
Iron	K161SB008	2550	mg/kg	=	NA	5,130
Lead[a]	K161SB008	22.30	mg/kg	=	400	6.43
Magnesium	K161SB008	629.0	mg/kg	=	NA	EN/NA
Manganese	K161SB008	31.90	mg/kg	=	475	5.93
Mercury	K161SB008	0.040	mg/kg	=	1.04	NC
Nickel	K161SB008	3.10	mg/kg	J	50	2.64
Potassium	K161SB008	139.0	mg/kg	=	NA	EN/NA
Sodium	K161SB008	36.70	mg/kg	J	NA	EN/NA
Vanadium	K161SB008	7.70	mg/kg	=	275	12.2
Zinc	K161SB008	30.30	mg/kg	J	7,000	NC

Values exceeding both RBCs and background values or cleanup goals appear in bolded and outlined text.
Screening criteria are listed for detected constituents.

= Analyte was detected; the reported value is equal to the sample concentration.
[a] SSL and RBC for lead are equal to the screening level established by the U.S. EPA (Soil Screening Guidance, 1006)
[vi] SSL and RBC are based on values for Cr+6.
EN Compound is an essential nutrient.
J Analyte was detected; the reported value is an estimated concentration.
mg/kg milligram per kilogram
NA Information is not available or not applicable.
NC BRC was not calculated due to a large number of non-detects (>90%).
ng/kg nanogram per kilogram
U Analyte was not detected; the reported value is the detection limit.
UJ Analyte was not detected; the reported value is an estimated detection limit.

TABLE 4-3
Compounds Detected in Vertical Profile Samples (April 27, 2001)
RFI Report Addendum, SWMU 161, Zone K, CNC

Location	Parameter	Depth (feet)	Concentration (µg/L)	Qualifier	MCL	Region III RBC
K161VP001	cis-1,2-Dichloroethylene	5	0.69	J	70	61
	1,2-Dichloroethene (Total)		0.69	J	NA	55
	Trichloroethylene (TCE)		**32**	=	5	1.6
	Benzene	10	0.15	J	5	0.32
	cis-1,2-Dichloroethylene		5.6	=	70	61
	1,2-Dichloroethene (Total)		5.6	=	NA	55
	Trichloroethylene (TCE)	10	**207**	=	5	1.6
	Benzene	15	0.39	J	5	0.32
	cis-1,2-Dichloroethylene		21.9	=	70	61
	trans-1,2-Dichloroethene		0.64	J	100	120
	1,2-Dichloroethene (Total)		22.6	=	NA	55
	Trichloroethylene (TCE)	15	**700**	=	5	1.6
	Benzene	20	0.18	J	5	0.32
	cis-1,2-Dichloroethylene		15.9	=	70	61
	trans-1,2-Dichloroethene		0.72	J	100	120
	1,2-Dichloroethene (Total)		16.6	=	NA	55
	Trichloroethylene (TCE)	20	**316**	=	5	1.6
	Benzene	25	0.68	J	5	0.32
	cis-1,2-Dichloroethylene		10.8	=	70	61
	1,2-Dichloroethene (Total)		10.8	=	NA	55
	Methyl ethyl ketone (2-Butanone)		0.86	J	NA	1,900
	Trichloroethylene (TCE)		**73.5**	=	5	1.6
K161VP002	cis-1,2-Dichloroethylene	4.5	17	=	70	61
	1,2-Dichloroethene (Total)		17	=	NA	55
	Tetrachloroethylene (PCE)		1.4	J	5	1.1
	Trichloroethylene (TCE)		**8.1**	=	5	1.6
	Vinyl chloride		**3.6**	J	2	0.019
	Chlorobenzene	10	0.58	J	NA	110
	cis-1,2-Dichloroethylene		0.21	J	70	61
	1,2-Dichloroethene (Total)		0.21	J	NA	55

TABLE 4-3
Compounds Detected in Vertical Profile Samples (April 27, 2001)
RFI Report Addendum, SWMU 161, Zone K, CNC

Location	Parameter	Depth (feet)	Concentration (µg/L)	Qualifier	MCL	Region III RBC
K161VP002	Trichloroethylene (TCE)	10	**5.4**	=	5	1.6
	Chlorobenzene	15	0.48	J	NA	110
	cis-1,2-Dichloroethylene		2.9	J	70	61
	1,2-Dichloroethene (Total)		2.9	J	NA	55
	Trichloroethylene (TCE)		**89.6**	=	5	1.6
	Benzene	20	0.25	J	5	0.32
	cis-1,2-Dichloroethylene		19.8	=	70	61
	trans-1,2-Dichloroethene		1	J	100	120
	1,2-Dichloroethene (Total)		20.8	=	NA	55
	Trichloroethylene (TCE)	20	**354**	=	5	1.6
K161VP002	Benzene	25	3.1	J	5	0.32
	Toluene		1.4	J	1,000	750
	cis-1,2-Dichloroethylene		24.5	=	70	61
	1,2-Dichloroethene (Total)	25	24.5	=	NA	55
	Methyl ethyl ketone (2-Butanone)		2	J	NA	1,900
	Trichloroethylene (TCE)		**94.2**	=	5	1.6
	Xylenes, Total		0.24	J	10,000	12,000
	o-Xylene		0.24	J	NA	12,000
K161VP003	Benzene	5	0.18	J	5	0.32
	cis-1,2-Dichloroethylene		6	=	70	61
	1,2-Dichloroethene (Total)		6	=	NA	55
	Trichloroethylene (TCE)		1.2	J	5	1.6
	Vinyl chloride		1.6	J	2	0.019
	cis-1,2-Dichloroethylene	10	0.47	J	70	61
	1,2-Dichloroethene (Total)		0.47	J	NA	55
	Trichloroethylene (TCE)		**5.6**	=	5	1.6
	cis-1,2-Dichloroethylene	15	0.79	J	70	61
	1,2-Dichloroethene (Total)		0.79	J	NA	55
	Trichloroethylene (TCE)		**10**	=	5	1.6
	Benzene	20	0.26	J	5	0.32
	cis-1,2-Dichloroethylene		40.4	=	70	61

TABLE 4-3
Compounds Detected in Vertical Profile Samples (April 27, 2001)
RFI Report Addendum, SWMU 161, Zone K, CNC

Location	Parameter	Depth (feet)	Concentration (µg/L)	Qualifier	MCL	Region III RBC
K161VP003	trans-1,2-Dichloroethene	20	0.91	J	100	120
	1,2-Dichloroethene (Total)		41.4	=	NA	55
	Trichloroethylene (TCE)	20	**325**	=	5	1.6
	Benzene	25	1.2	J	5	0.32
	cis-1,2-Dichloroethylene		30.3	=	70	61
	1,2-Dichloroethene (total)		30.3	=	NA	55
	Trichloroethylene (TCE)	25	**93.2**	=	5	1.6

Exceedances of the MCL or RBC (when MCL was not available) appear in bolded and outlined text.

=	Analyte was detected; the reported value is equal to the sample concentration.
J	Analyte was detected; the reported value is an estimated concentration.
NA	Information is not available or not applicable.
µg/L	microgram per liter

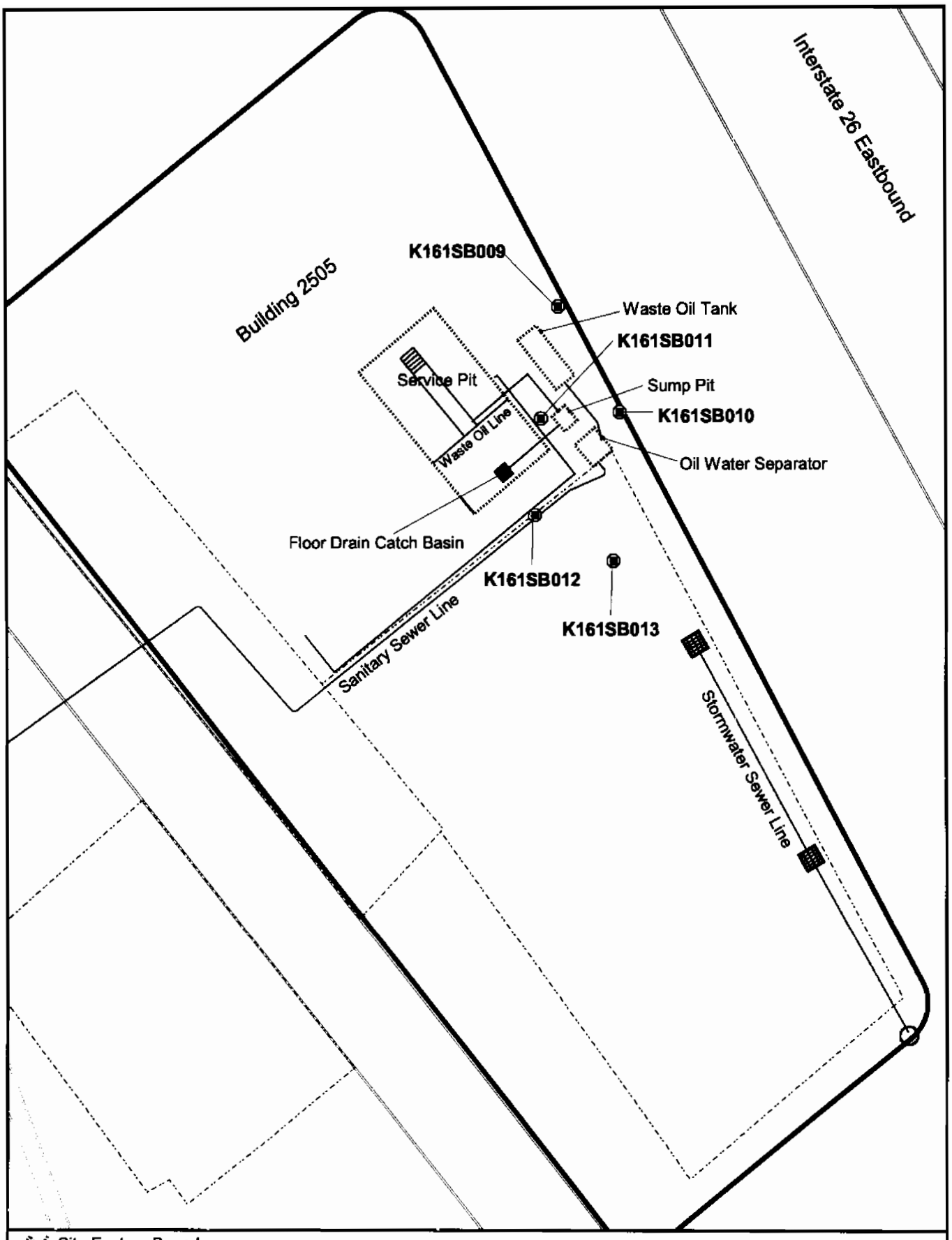

Figure 4-1
Soil Sample Locations
SWMU 161, Zone K
Charleston Naval Complex

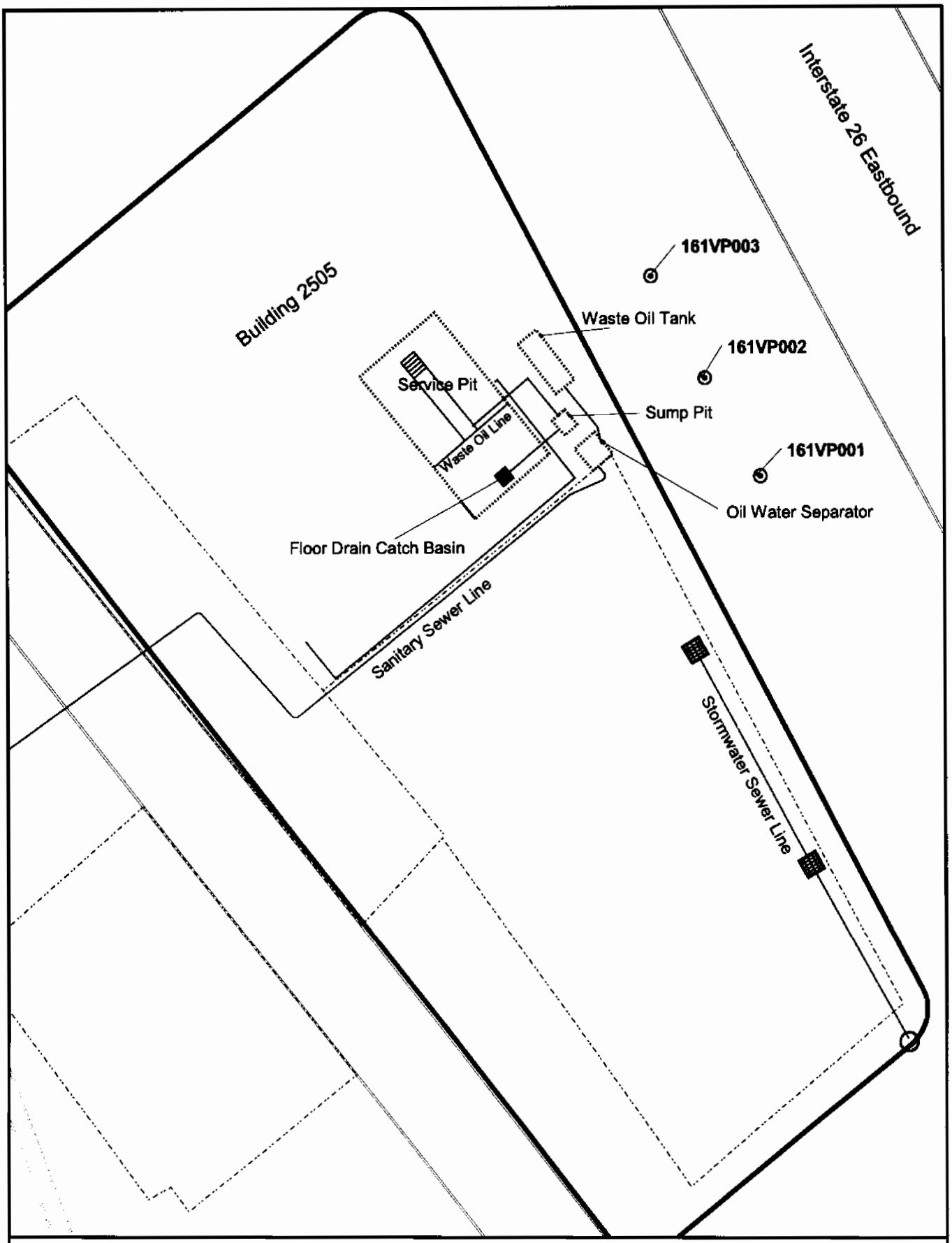

Figure 4-2
Vertical Profile Sample Locations
SWMU 161, Zone K
Charleston Naval Complex

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Section 5.0

5.0 COPC/COC Refinement

This section discusses compounds requiring further evaluation that were identified in previous sections. The discussion includes data that were collected during and after completion of the RFI.

5.1 Surface Soil

The *Zone K RFI Report, Revision 0* (EnSafe, 1999a) did not identify COPCs in SWMU 161 surface soil. TPH-DRO was detected at a concentration exceeding its screening criteria of 100 mg/kg in one (161SB007) of eight surface soil samples collected and analyzed for TPH. Results from surface soil samples for TPH-DRO are provided in Table 5-1. TPH-DRO will be discussed further in this section.

Based on the data collected after completion of the RFI, no COPCs requiring additional evaluation were identified.

5.1.1 TPH-DRO

TPH-DROs were detected above the CNC screening level of 100 mg/kg in one surface soil sample (161SB00701 at 314 mg/kg) collected at SWMU 161. TPH-DROs were also detected at a concentration below the CNC screening level in surface soil at K161SB006 at a concentration of 11.8 mg/kg. TPH-DROs were not detected in the other six surface soil samples collected and analyzed for TPH. TPH-gasoline range organics (GROs) were not detected in the eight surface soil samples analyzed for TPH at SWMU 161.

TPH analysis is generally used as a screening value to determine where, and if, additional samples should be collected. TPH results represent the cumulative concentrations of a variety of long-chain hydrocarbons. GRO analysis includes carbon chains of up to 10 carbon atoms long; DRO analysis is specific to carbon chains of 10 to approximately 28 carbon atoms. The TPH analysis can be influenced by many compounds with the appropriate number of carbon atoms that are not necessarily related to petroleum products.

Whenever TPH analysis exceeds the screening criteria, VOC and SVOC analyses should be considered to determine which constituent(s) contributed to the TPH results. The *South Carolina Risk-Based Corrective Action for Petroleum Releases* document (Bureau of Underground Storage Tank Management, 1998) has identified BTEX, methyl tert-butyl ether (MTBE), and several PAHs (total naphthalene, benzo[a]anthracene, benzo[b]fluoranthene,

benzo[k]fluoranthene, chrysene, and dibenz[a-h]anthracene) as hydrocarbon COCs for releases of used petroleum products based on their toxicity, mobility, persistence, and presence in material released.

At SWMU 161, sample K161SB00701 was analyzed for both VOC and SVOCs. However, none of the other organic constituents identified in the *South Carolina Risk-Based Corrective Action for Petroleum Releases* document were detected. Additionally, none of the inorganic compounds were detected at concentrations above their respective RBCs and BRCs.

Soil boring K161SB007 is located approximately four feet from the entrance to the wash rack and service pit and is approximately the same distance from the OWS. Soil boring K161SB006 is located a few feet south of the OWS and is approximately 10 feet to the east-southeast of K161SB007. The sample from K61SB006 reported a TPH-DRO concentration of 11.8 mg/kg.

The RFA reported that no documented spills have occurred at SWMU 161 (EnSafe, 1995). Site data appear to confirm the absence of a significant spill of petroleum products from the OWS. Surface water, and any significant spill from the OWS, would be expected to follow the SWMU boundary to the stormwater collection system. Soil boring K161SB006 is located between the OWS and the stormwater collection system, and is adjacent to this unit's parking area. This sample would be expected to report the highest levels of TPH-DROs in the event of an OWS spill as it is located very close to, and downgradient of, the OWS. The detected level of TPH-DROs (11.8 mg/kg) likely resulted from a small leak from a parked vehicle rather than from an OWS spill. Sample K161SB00701 reported the highest level (314 mg/kg) of TPH-DROs. The location of this sample, which is upgradient to the OWS, suggests that reported concentrations of TPH-DROs are also likely the result of a small vehicle oil leak or spill. Based on this information and the low frequency of detection, the locations where TPH-DROs were reported do not represent a significant source area of contamination. CH2M-Jones concurs with the conclusion of the *Zone K RFI Report, Revision 0* that TPH-DROs do not require further investigation and are not considered COPCs in surface soil at SWMU 161. Additional information related to toxicity screening criteria is presented in the next section for additional clarification as to why TPH is not a COC at this site.

5.2 Risk-Based Evaluation of TPHs

5.2.1 Brief Overview of TPH Toxicity Criteria

A toxicity value is not available for the results of a total petroleum hydrocarbon (TPH) analysis. For this reason, neither a preliminary remediation goal (PRG) nor an RBC is provided in the existing EPA criteria tables. The reason the toxicity value is not available is that the TPH analysis measures the total presence of a broad range of hydrocarbons while the typical toxicity data sources, such as EPA's Integrated Risk Information System (IRIS) database, have been developed for individual chemicals.

However, a set of human health toxicity criteria was developed from the toxicity studies available for various petroleum hydrocarbons. In 1993, the State of Massachusetts initially proposed these toxicity criteria for petroleum hydrocarbon fractions in its *Petroleum Policy: Development of Health-Based Alternative to the TPH Parameter*. In 1997, the Total Petroleum Hydrocarbon Criteria Work Group (TPHCWG) accepted these values. These toxicity criteria are used by several states to develop health-based criteria such as RBCs, PRGs, and soil cleanup target levels (SCTLs).

Depending on the length of the hydrocarbon chain, a variety of RBC/SCTL values are available. Some states use a surrogate approach, which assumes that composition of the TPHs contains a portion of alkanes and alkenes, with carbon chain lengths ranging between C5-C35. For example, the State of Massachusetts has extensive guidance that includes toxicity factors for different petroleum hydrocarbons based on carbon chain length. The State of Florida used the TPHCWG-proposed toxicity factors and derived SCTLs for aliphatic (straight chain) hydrocarbons and aromatic (benzene-ring containing TPH) hydrocarbons. These SCTLs can be accessed from the State of Florida website at : http://www.dep.state.fl.us/dwm/programs/brownfields. Table 5-2 lists some of these values.

5.2.2 Discussion of SWMU 161 TPH Results

One sample at SWMU 161 (161SB00701) reported TPHs at 314 mg/kg. This sample did not have detectable aromatic hydrocarbons (e.g., BTEX or PAHs). Therefore, the TPH-DRO detected are aliphatic hydrocarbons. RBCs (SCTLs) for aliphatic hydrocarbons of varying chain lengths are listed in Table 5-2.

Although the specific hydrocarbon composition is not known for the detected concentration at SWMU 161, none of the detected soil concentrations at SWMU 161 were above any of the

listed criteria. Therefore, the detected TPH does not present direct exposure concerns or a leachability concern at SWMU 161.

The potential source of the petroleum hydrocarbons detected could be from grease or oil used for lubrication in vehicles, and from small oil leaks from parked vehicles. It does not appear to be widespread in distribution.

Based on the reasons such as absence of unacceptable human health risks, and lack of widespread contamination, TPH is not considered a COC for this site.

5.3 Subsurface Soil

No COPCs were identified in subsurface soil at SWMU 161 that require further evaluation.

5.4 Groundwater

No COPCs were identified in groundwater related to SWMU 161 that require further evaluation.

5.5 Summary

Based on the evaluation of data collected as part of and subsequent to the RFI, no COCs are present in environmental media (soil and groundwater) related to SWMU 161 that require further evaluation.

TABLE 5-1
Surface Soil Results for Total Petroleum Hydrocarbons (TPH)
RFI Report Addendum, SWMU 161, Zone K, CNC

Parameter	Location	Concentration (mg/kg)	Qualifier	Screening Value*
TPH - Diesel Range Organics (DROs)	K161SB001	5.22	U	100
	K161SB002	5.22	U	
	K161SB003	5.30	U	
	K161SB004	5.36	U	
	K161SB005	5.35	U	
	K161SB006	11.8	=	
	K161SB007	**314.0**	=	
	K161SB008	5.50	U	
TPH - Gasoline Range Organics (GROs)	K161SB001	0.209	U	100
	K161SB002	0.209	U	
	K161SB003	0.212	U	
	K161SB004	0.214	U	
	K161SB005	0.214	U	
	K161SB006	0.226	U	
	K161SB007	0.218	U	
	K161SB008	0.220	U	

Values exceeding screening criteria appear in bolded and outlined text.

*100 mg/kg screening value established by BCT.

= Analyte was detected; the reported value is equal to the sample concentration.
J Analyte was detected; the reported value is an estimated concentration.
mg/kg milligram per kilogram
U Analyte was not detected; the reported value is the detection limit.
UJ Analyte was not detected; the reported value is an estimated detection limit.

TABLE 5-2
Health-based TPH SCTLs
RFI Report Addendum, SWMU 161, Zone K, CNC

	SCTL (mg/kg)*		
TRPH Class	**Residential**	**Industrial**	**Leachability**
C5-C6 – Aliphatic	4,300	29,000	470
C6-C8 – Aliphatic	5,900	40,000	1,200
C8-C10 – Aliphatic	650	4,600	6,700
C10-C12 – Aliphatic	1300	9,600	49,000
C12-C16 – Aliphatic	2,400	20,000	1,100,000
C16-C35 – Aliphatic	31,000	240,000	110,000,000

*Values are from FDEP Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-770, F.A.C, January 18, 1997. Final.

SCTL soil cleanup target levels

mg/kg milligram per kilogram

Section 6.0

6.0 Summary of Information Related to Site Closeout Issues

6.1 RFI Status

The *Zone K RFI Report, Revision 0* (EnSafe, 1999a) addressed SWMUs/AOCs within the Naval Annex, including SWMU 161. The subsequent *Zone K RFI Work Plan Addendum* (EnSafe, 1999b) recommended collecting additional samples to delineate TPH-DROs detected above the TPH screening level (100 mg/kg) in surface soil at soil boring K161SB007. In addition, since no surface samples were analyzed for dioxins, and dioxins were detected in subsurface sample K161SB00202 and in the first groundwater sampling event, the RFI Work Plan Addendum recommended collecting samples for dioxin analysis. This additional sampling has been completed. EnSafe's RFI Work Plan Addendum recommended collecting another sample from monitor well K161GW001 to confirm the presence or absence of VOCs and dioxins in site groundwater. This sample has been collected and the results are discussed in Section 4.0 of this RFI Report Addendum.

CH2M-Jones' RFI Work Plan Addendum (2000) recommended collecting vertical profile samples at three locations. These samples have been collected, and the results are discussed in Section 4.0 of this RFI Report Addendum.

No other samples are proposed or considered necessary at SWMU 161.

In accordance with the RFI completion process, if a determination of no further investigation (NFI) is made, then a site may proceed to either NFA status or to a CMS. CH2M-Jones recommends NFA for this site.

6.2 Presence of Inorganics in Groundwater

For the purpose of site closeout documentation, the inorganics in groundwater issue refers to the occasional or intermittent detection of several metals, primarily arsenic, thallium, and antimony, in groundwater at concentrations above the applicable MCL, preceded or followed by detections of these same metals below the MCL or below the practicable quantitation limit.

One groundwater well (K161GW001) is present at SWMU 161. This well was sampled four times between January and October 1997 and the samples were analyzed for metals. The analytical results for monitor well K161GW001 are presented in Table 6-1. Antimony, arsenic, and thallium were not detected in any of the samples collected from the SWMU 161 monitor well. Therefore, the presence of inorganics in groundwater does not warrant further investigation at SWMU 161.

6.3 Potential Linkage to SWMU 37, Investigated Sanitary Sewers at the CNC

Because of the location of this site at the Naval Annex, there is no potential linkage to SWMU 37, which is located at the Charleston Naval Shipyard. Furthermore, there are no COCs that could migrate from the site.

6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC

Because of the location of this site at the Naval Annex, no linkage to AOC 699, the storm sewer at the Charleston Naval Shipyard, is possible. In addition, because there were no COCs identified in groundwater or soil, COC migration is not a concern at this site.

6.5 Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC

Investigated railroad lines were identified in the Zone L RFI (EnSafe, 1998). No investigated railroad lines were identified in Zone K. The nearest investigated railroad line to SWMU 161 is nearly three miles to the east-southeast within the CNC. There is no known linkage between SWMU 161 and the investigated railroad lines at AOC 504. Therefore, further evaluation of this issue is not warranted.

6.6 Potential Migration Pathways to Surface Water Bodies at the CNC

Two potential migration pathways from the site to surface water are overland flow via stormwater runoff, and subsurface flow via groundwater. There were no COCs identified in surface soil at SWMU 161. Therefore, further evaluation of a potential pathway for contaminant migration via stormwater runoff is not warranted.

There were no COCs identified in groundwater related to activities at SWMU 161. As such, there is no contaminated groundwater plume to migrate to a surface water body. Therefore, further evaluation of potential migration of contaminated groundwater to a surface water body is not warranted.

6.7 Potential Contamination in Oil/Water Separators (OWSs)

The issue of potential contamination of OWSs refers to the possible presence of an OWS that has not yet been investigated at a SWMU or AOC as part of the RCRA or UST process.

An OWS is present at SWMU 161. Samples have been collected to determine if the OWS has impacted environmental media at SWMU 161. It has been determined from these samples that the OWS has not impacted environmental media at the site. Therefore, additional evaluation of this issue at SWMU 161 is not warranted.

6.8 Land Use Control Management Plan

Evaluation of data collected during and after the RFI did not identify any COCs in site soil at SWMU 161. Therefore, land use restrictions at SWMU 161 are not warranted.

TABLE 6-1
Inorganics in Groundwater
RFI Report Addendum, SWMU 161, Zone K, CNC

Parameter	Location	Concentration (µg/L)	Qualifier	MCL (µg/L)	BRC (µg/L)
Antimony	K161GW001	1.9	U	6.0	NC
	K161GW001	2.2	U		
	K161GW001	2.0	U		
	K161GW001	2.8	U		
Arsenic	K161GW001	1.7	U	50	NC
	K161GW001	3.0	U		
	K161GW001	2.8	U		
	K161GW001	1.8	UJ		
Thallium	K161GW001	6.0	U	2.0	NC
	K161GW001	5.2	U		
	K161GW001	3.9	U		
	K161GW001	6.7	U		

BRC background reference concentration
J Compound was detected and the concentration is an estimated value.
MCL maxium contaminant level
NC BRC was not calculated due to the large number of non-detects.
U Compound was not detected.
UJ Compound was not detected and the value provided is estimated.
µg/L microgram per liter

Section 7.0

7.0 Recommendations

Based on evaluation of data collected during and after completion of the RFI, COCs were not identified in environmental media at SWMU 161. Based on this information, further investigation or corrective action is not considered necessary at SWMU 161. Therefore, CH2M-Jones recommends that the status of SWMU 161 be changed to NFA.

Once the BCT concurs that NFA is appropriate for the site, a Statement of Basis will be prepared that will be made available for public comment in accordance with SCDHEC policy. This will allow for public participation in the final remedy selection .

Section 8.0

8.0 References

CH2M-Jones. *RFI Report Work Plan Addendum – Zone K Naval Station Annex, Charleston Naval Complex*. September 2000.

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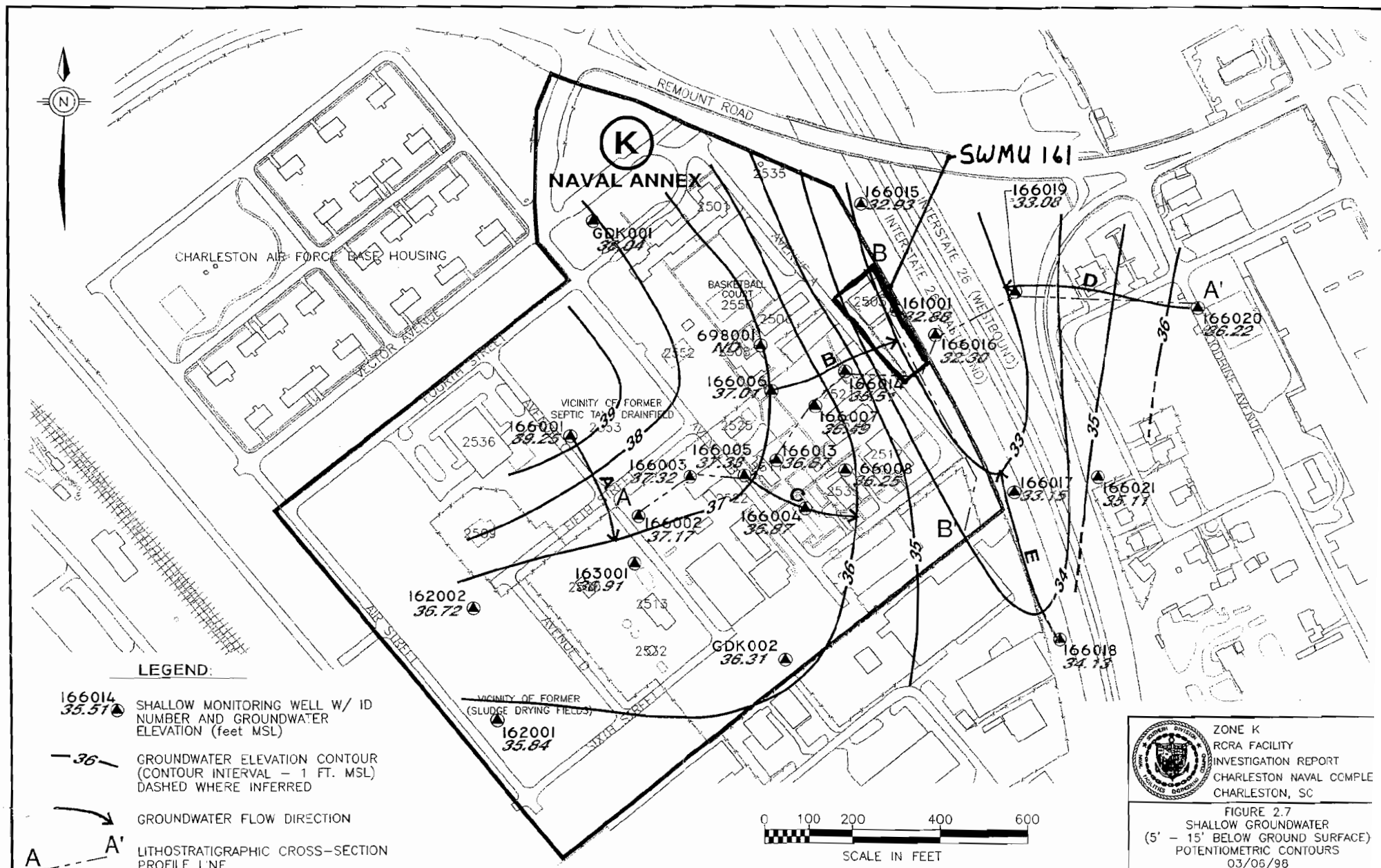
EnSafe Inc. *Zone K RFI Report*. Revision 0. June 11, 1999a.

EnSafe Inc. *Final Zone K RFI Report Work Plan Addendum*. November 16, 1999b.

Florida Department of Environmental Protection (FDEP). *Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-770, F.A.C.* Final. January 18, 1997.

Appendix A



ZONE K
RCRA FACILITY
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CHARLESTON NAVAL COMPLE
CHARLESTON, SC

FIGURE 2.7
SHALLOW GROUNDWATER
(5' – 15' BELOW GROUND SURFACE)
POTENTIOMETRIC CONTOURS
03/06/98

Date: 05/11/99 | DWG Name: 29110062

Appendix B

	StationID	K161SB008		K161SB008		K161SB008		K161SB008	
	SampleID	161SB008S1 (0-1ft)		161SB008S2 (3-5ft)		161SB008T1 (0-1ft)		161SB008T2 (3-5ft)	
	DateCollected	10/12/1999		10/12/1999		10/12/1999		10/12/1999	
	DateAnalyzed	10/20/99		10/20/99		10/20/99		10/20/99	
	SDGNumber	NBCK01		NBCK01		NBCK01		NBCK01	
Parameter	**Units**								
Aluminum	mg/kg					6020	=	6470	=
Antimony	mg/kg					0.2	UJ	0.2	UJ
Arsenic	mg/kg					2.5	=	2.2	=
Barium	mg/kg					8.9	=	9.9	=
Beryllium	mg/kg					0.03	J	0.01	UJ
Cadmium	mg/kg					0.14	J	0.04	UJ
Calcium	mg/kg					88100	J	31000	J
Chromium, Total	mg/kg					7.2	=	6.8	=
Cobalt	mg/kg					1	J	0.59	J
Copper	mg/kg					1.7	J	5.5	=
Iron	mg/kg					2950	=	2550	=
Lead	mg/kg					22.9	=	22.3	=
Magnesium	mg/kg					1540	=	629	=
Manganese	mg/kg					78.2	=	31.9	=
Mercury	mg/kg					0.03	=	0.04	=
Nickel	mg/kg					4.3	J	3.1	J
Potassium	mg/kg					305	=	139	=
Selenium	mg/kg					0.3	U	0.29	U
Silver	mg/kg					0.06	UJ	0.06	UJ
Sodium	mg/kg					69.2	=	36.7	J
Thallium	mg/kg					0.36	UJ	0.36	UJ
Tin (Sn)	mg/kg					1.9	U	2.1	U
Vanadium	mg/kg					8.2	=	7.7	=
Zinc	mg/kg					47.9	J	30.3	J
Aluminum, SPLP	µg/L	7710	J	7020	J				
Antimony, SPLP	µg/L	1.8	UJ	1.8	UJ				
Arsenic,SPLP	µg/L	4	J	3.6	U				
Barium, SPLP	µg/L	11.4	=	10.4	=				
Beryllium, SPLP	µg/L	0.1	UJ	0.1	UJ				
Cadmium, SPLP	µg/L	0.4	UJ	0.4	UJ				
Calcium, SPLP	µg/L	10200	=	9500	=				
Cobalt, SPLP	µg/L	0.7	U	0.7	U				
Copper, SPLP	µg/L	0.6	UJ	1.1	UJ				
Iron, SPLP	µg/L	3060	J	2240	J				
Lead, SPLP	µg/L	37.6	=	22.3	=				
Magnesium, SPLP	µg/L	731	J	657	J				
Manganese, SPLP	µg/L	5.6	J	3.4	J				
Mercury, SPLP	µg/L	0.1	U	0.1	U				
Nickel, SPLP	µg/L	3.8	J	2.1	J				
Potassium, SPLP	µg/L	236	U	191	U				

	StationID	K161SB008		K161SB008		K161SB008	K161SB008
	SampleID	161SB008S1 (0-1ft)		161SB008S2 (3-5ft)		161SB008T1 (0-1ft)	161SB008T2 (3-5ft)
	DateCollected	10/12/1999		10/12/1999		10/12/1999	10/12/1999
	DateAnalyzed	10/20/99		10/20/99		10/20/99	10/20/99
	SDGNumber	NBCK01		NBCK01		NBCK01	NBCK01
Parameter	**Units**						
Selenium, SPLP	µg/L	2.6	UJ	2.6	UJ		
Silver, SPLP	µg/L	0.5	UJ	0.5	UJ		
Sodium, SPLP	µg/L	1110	=	1000	=		
Thallium, SPLP	µg/L	3.2	UJ	3.2	UJ		
Tin (Sn), SPLP	µg/L	2.8	U	2.8	U		
Vanadium, SPLP	µg/L	10.4	=	8.4	J		
Chromium, Total	µg/L	6.6	J	5.3	J		
Zinc, SPLP	µg/L	63.3	=	29.9	U		

Parameter	Units	StationID	SampleID	DateCollected	DateAnalyzed	SDGNumber
		K161SB004	K161SB004	K161SB008	K161SB008	
		161CB004S2 (3-5ft)	161SB004T2 (3-5ft)	161SB008T1 (0-1ft)	161SB008T2 (3-5ft)	
		10/18/1999	10/18/1999	10/12/1999	10/12/1999	
		10/22/99	10/22/99	10/18/99	10/18/99	
		NBCK04	NBCK04	NBCK01	NBCK01	
Total Organic Carbon	mg/kg	500 U	500 U	5200 =	6000 =	

	StationID	K161SB004		K161SB004		K161SB004		K161SB009	
	SampleID	161CB004S2 (3-5ft)		161SB004S2 (3-5ft)		161SB004T2 (3-5ft)		161SB00901 (0-1ft)	
	DateCollected	10/18/1999		10/18/1999		10/18/1999		11/17/1999	
	DateAnalyzed	10/28/99		10/28/99		10/28/99		11/28/99	
	SDGNumber	NBCK04		NBCK04		NBCK04		NBCK05	
Parameter	Units								
Chloromethane	ug/Kg	15	U			21	U	8.2	U
Vinyl chloride	ug/Kg	15	U			21	U	8.2	U
Bromomethane	ug/Kg	15	U			21	U	8.2	U
Chloroethane	ug/Kg	15	U			21	U	8.2	U
1,1-Dichloroethene	ug/Kg	7.6	U			10	U	4.1	U
Acetone	ug/Kg	76	U			100	U	41	U
Carbon Disulfide	ug/Kg	7.6	U			10	U	4.1	U
Methylene Chloride	ug/Kg	7.6	U			10	U	4.1	U
1,1-Dichloroethane	ug/Kg	7.6	U			10	U	4.1	U
Vinyl acetate	ug/Kg	15	U			21	U	8.2	U
Methyl ethyl ketone (2-Butanone)	ug/Kg	38	U			52	U	20	U
1,2-Dichloroethene (total)	ug/Kg	7.6	U			10	U	4.1	U
Chloroform	ug/Kg	7.6	U			10	U	4.1	U
1,1,1-Trichloroethane	ug/Kg	7.6	U			10	U	4.1	U
Carbon Tetrachloride	ug/Kg	7.6	U			10	U	4.1	U
1,2-Dichloroethane	ug/Kg	7.6	U			10	U	4.1	U
Benzene	ug/Kg	7.6	U			10	U	4.1	U
Trichloroethylene (TCE)	ug/Kg	7.6	U			10	U	4.1	U
1,2-Dichloropropane	ug/Kg	7.6	U			10	U	4.1	U
Bromodichloromethane	ug/Kg	7.6	U			10	U	4.1	U
2-Chloroethyl vinyl ether	ug/Kg	76	R			100	R	41	R
cis-1,3-Dichloropropene	ug/Kg	7.6	U			10	U	4.1	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/Kg	38	U			52	U	20	U
Toluene	ug/Kg	7.6	U			10	U	4.1	U
trans-1,3-Dichloropropene	ug/Kg	7.6	U			10	U	4.1	U
1,1,2-Trichloroethane	ug/Kg	7.6	U			10	U	4.1	U
2-Hexanone	ug/Kg	38	U			52	U	20	U
Tetrachloroethylene (PCE)	ug/Kg	7.6	U			10	U	4.1	U
Dibromochloromethane	ug/Kg	7.6	U			10	U	4.1	U
Chlorobenzene	ug/Kg	7.6	U			10	U	4.1	U
Ethylbenzene	ug/Kg	7.6	U			10	U	4.1	U
Xylenes, Total	ug/Kg	15	U			21	U	8.2	U
Styrene	ug/Kg	7.6	U			10	U	4.1	U
Bromoform	ug/Kg	7.6	U			10	U	4.1	U
1,1,2,2-Tetrachloroethane	ug/Kg	7.6	U			10	U	4.1	U
Chloromethane, SPLP	µg/L	10	U	10	U				
Vinyl Chloride, SPLP	µg/L	10	U	10	U				
Toluene, SPLP	µg/L	5	U	5	U				
Bromomethane, SPLP	µg/L	10	U	10	U				
Chloroethane, SPLP	µg/L	10	U	10	U				

	StationID	K161SB009		K161SB010		K161SB010		K161SB011	
	SampleID	161SB00902 (3-5ft)		161SB01001 (0-1ft)		161SB01002 (3-5ft)		161SB01101 (0-1ft)	
	DateCollected	11/17/1999		11/17/1999		11/17/1999		11/17/1999	
	DateAnalyzed	11/28/99		11/28/99		11/28/99		11/28/99	
	SDGNumber	NBCK05		NBCK05		NBCK05		NBCK05	
Parameter	Units								
Chloromethane	ug/Kg	10	U	7.7	U	9.1	U	8.9	U
Vinyl chloride	ug/Kg	10	U	7.7	U	9.1	U	8.9	U
Bromomethane	ug/Kg	10	U	7.7	U	9.1	U	8.9	U
Chloroethane	ug/Kg	10	U	7.7	U	9.1	U	8.9	U
1,1-Dichloroethene	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Acetone	ug/Kg	51	U	38	U	46	U	44	U
Carbon Disulfide	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Methylene Chloride	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
1,1-Dichloroethane	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Vinyl acetate	ug/Kg	10	U	7.7	U	9.1	U	8.9	U
Methyl ethyl ketone (2-Butanone)	ug/Kg	26	U	19	U	23	U	22	U
1,2-Dichloroethene (total)	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Chloroform	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
1,1,1-Trichloroethane	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Carbon Tetrachloride	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
1,2-Dichloroethane	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Benzene	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Trichloroethylene (TCE)	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
1,2-Dichloropropane	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Bromodichloromethane	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
2-Chloroethyl vinyl ether	ug/Kg	51	R	38	R	46	R	44	R
cis-1,3-Dichloropropene	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/Kg	26	U	19	U	23	U	22	U
Toluene	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
trans-1,3-Dichloropropene	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
1,1,2-Trichloroethane	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
2-Hexanone	ug/Kg	26	U	19	U	23	U	22	U
Tetrachloroethylene (PCE)	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Dibromochloromethane	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Chlorobenzene	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Ethylbenzene	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Xylenes, Total	ug/Kg	10	U	7.7	U	9.1	U	8.9	U
Styrene	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Bromoform	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
1,1,2,2-Tetrachloroethane	ug/Kg	5.1	U	3.8	U	4.6	U	4.4	U
Chloromethane, SPLP	µg/L								
Vinyl Chloride, SPLP	µg/L								
Toluene, SPLP	µg/L								
Bromomethane, SPLP	µg/L								
Chloroethane, SPLP	µg/L								

	StationID	K161SB011		K161SB012		K161SB012		K161SB012	
	SampleID	161SB01102 (3-5ft)		161CB01201a (0-1ft)		161SB01201a (0-1ft)		161SB01202a (3-5ft)	
	DateCollected	11/17/1999		11/17/1999		11/17/1999		11/17/1999	
	DateAnalyzed	11/28/99		11/28/99		11/28/99		11/28/99	
	SDGNumber	NBCK05		NBCK05		NBCK05		NBCK05	
Parameter	Units								
Chloromethane	ug/Kg	8.2	U	11	U	11	U	8.4	U
Vinyl chloride	ug/Kg	8.2	U	11	U	11	U	8.4	U
Bromomethane	ug/Kg	8.2	U	11	U	11	U	8.4	U
Chloroethane	ug/Kg	8.2	U	11	U	11	U	8.4	U
1,1-Dichloroethene	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Acetone	ug/Kg	41	U	54	U	53	U	42	U
Carbon Disulfide	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Methylene Chloride	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
1,1-Dichloroethane	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Vinyl acetate	ug/Kg	8.2	U	11	U	11	U	8.4	U
Methyl ethyl ketone (2-Butanone)	ug/Kg	20	U	27	U	26	U	21	U
1,2-Dichloroethene (total)	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Chloroform	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
1,1,1-Trichloroethane	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Carbon Tetrachloride	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
1,2-Dichloroethane	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Benzene	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Trichloroethylene (TCE)	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
1,2-Dichloropropane	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Bromodichloromethane	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
2-Chloroethyl vinyl ether	ug/Kg	41	R	54	R	53	R	42	R
cis-1,3-Dichloropropene	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/Kg	20	U	27	U	26	U	21	U
Toluene	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
trans-1,3-Dichloropropene	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
1,1,2-Trichloroethane	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
2-Hexanone	ug/Kg	20	U	27	U	26	U	21	U
Tetrachloroethylene (PCE)	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Dibromochloromethane	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Chlorobenzene	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Ethylbenzene	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Xylenes, Total	ug/Kg	8.2	U	11	U	11	U	8.4	U
Styrene	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Bromoform	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
1,1,2,2-Tetrachloroethane	ug/Kg	4.1	U	5.4	U	5.3	U	4.2	U
Chloromethane, SPLP	µg/L								
Vinyl Chloride, SPLP	µg/L								
Toluene, SPLP	µg/L								
Bromomethane, SPLP	µg/L								
Chloroethane, SPLP	µg/L								

	StationID	K161SB013		K161SB013	
	SampleID	161SB01301a (0-1ft)		161SB01302a (3-5ft)	
	DateCollected	11/17/1999		11/17/1999	
	DateAnalyzed	11/28/99		11/28/99	
	SDGNumber	NBCK05		NBCK05	
Parameter	Units				
Chloromethane	ug/Kg	13	U	11	U
Vinyl chloride	ug/Kg	13	U	11	U
Bromomethane	ug/Kg	13	U	11	U
Chloroethane	ug/Kg	13	U	11	U
1,1-Dichloroethene	ug/Kg	6.6	U	5.4	U
Acetone	ug/Kg	33	U	54	U
Carbon Disulfide	ug/Kg	6.6	U	5.4	U
Methylene Chloride	ug/Kg	6.6	U	5.4	U
1,1-Dichloroethane	ug/Kg	6.6	U	5.4	U
Vinyl acetate	ug/Kg	13	U	11	U
Methyl ethyl ketone (2-Butanone)	ug/Kg	33	U	27	U
1,2-Dichloroethene (total)	ug/Kg	6.6	U	5.4	U
Chloroform	ug/Kg	6.6	U	5.4	U
1,1,1-Trichloroethane	ug/Kg	6.6	U	5.4	U
Carbon Tetrachloride	ug/Kg	6.6	U	5.4	U
1,2-Dichloroethane	ug/Kg	6.6	U	5.4	U
Benzene	ug/Kg	6.6	U	5.4	U
Trichloroethylene (TCE)	ug/Kg	6.6	U	5.4	U
1,2-Dichloropropane	ug/Kg	6.6	U	5.4	U
Bromodichloromethane	ug/Kg	6.6	U	5.4	U
2-Chloroethyl vinyl ether	ug/Kg	66	R	54	R
cis-1,3-Dichloropropene	ug/Kg	6.6	U	5.4	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	ug/Kg	33	U	27	U
Toluene	ug/Kg	6.6	U	5.4	U
trans-1,3-Dichloropropene	ug/Kg	6.6	U	5.4	U
1,1,2-Trichloroethane	ug/Kg	6.6	U	5.4	U
2-Hexanone	ug/Kg	5.6	J	27	U
Tetrachloroethylene (PCE)	ug/Kg	6.6	U	5.4	U
Dibromochloromethane	ug/Kg	6.6	U	5.4	U
Chlorobenzene	ug/Kg	6.6	U	5.4	U
Ethylbenzene	ug/Kg	6.6	U	5.4	U
Xylenes, Total	ug/Kg	13	U	11	U
Styrene	ug/Kg	6.6	U	5.4	U
Bromoform	ug/Kg	6.6	U	5.4	U
1,1,2,2-Tetrachloroethane	ug/Kg	6.6	U	5.4	U
Chloromethane, SPLP	µg/L				
Vinyl Chloride, SPLP	µg/L				
Toluene, SPLP	µg/L				
Bromomethane, SPLP	µg/L				
Chloroethane, SPLP	µg/L				

	StationID	K161SB004		K161SB004		K161SB004	K161SB009
	SampleID	161CB004S2 (3-5ft)		161SB004S2 (3-5ft)		161SB004T2 (3-5ft)	161SB00901 (0-1ft)
	DateCollected	10/18/1999		10/18/1999		10/18/1999	11/17/1999
	DateAnalyzed	10/28/99		10/28/99		10/28/99	11/28/99
	SDGNumber	NBCK04		NBCK04		NBCK04	NBCK05
Parameter	**Units**						
1,1-Dichloroethene, SPLP	µg/L	5	U	5	U		
Acetone, SPLP	µg/L	50	R	50	R		
Carbon Disulfide, SPLP	µg/L	5	U	5	U		
Methylene Chloride, SPLP	µg/L	5	U	5	U		
1,2-Dichloropropane, SPLP	µg/L	5	U	5	U		
Vinyl acetate, SPLP	µg/L	10	U	10	U		
Methyl ethyl ketone (2-Butanone), SPLP	µg/L	25	U	25	U		
1,2-Dichloroethene (total), SPLP	µg/L	5	U	5	U		
Chloroform, SPLP	µg/L	5	U	5	U		
1,1,1-Trichloroethane, SPLP	µg/L	5	U	5	U		
1,1-Dichloroethane, SPLP	µg/L	5	U	5	U		
Carbon Tetrachloride, SPLP	µg/L	5	U	5	U		
1,2-Dichloroethane, SPLP	µg/L	5	U	5	U		
Benzene, SPLP	µg/L	5	U	5	U		
Trichloroethylene (TCE), SPLP	µg/L	5	U	5	U		
Bromodichloromethane, SPLP	µg/L	5	U	5	U		
2-Chloroethyl vinyl ether, SPLP	µg/L	50	R	50	R		
cis-1,3-Dichloropropene, SPLP	µg/L	5	U	5	U		
Methyl Isobutyl ketone (4-Methyl-2-pentanone),SPLP	µg/L	25	U	25	U		
trans-1,3-Dlichloropropene, SPLP	µg/L	5	U	5	U		
1,1,2-Trichloroethane, SPLP	µg/L	5	U	5	U		
2-Hexanone, SPLP	µg/L	25	U	25	U		
Tetrachloroethylene(PCE), SPLP	µg/L	5	U	5	U		
Dibromochloromethane, SPLP	µg/L	5	U	5	U		
Chlorobenzene, SPLP	µg/L	0.44	J	5	U		
Ethylbenzene, SPLP	µg/L	5	U	5	U		
Xylenes, Total, SPLP	µg/L	10	U	10	U		
Styrene, SPLP	µg/L	5	U	5	U		
Bromoform, SPLP	µg/L	5	U	5	U		
1,1,2,2-Tetrachloroethane, SPLP	µg/L	5	U	5	U		

	StationID	K161SB009	K161SB010	K161SB010	K161SB011
	SampleID	161SB00902 (3-5ft)	161SB01001 (0-1ft)	161SB01002 (3-5ft)	161SB01101 (0-1ft)
	DateCollected	11/17/1999	11/17/1999	11/17/1999	11/17/1999
	DateAnalyzed	11/28/99	11/28/99	11/28/99	11/28/99
	SDGNumber	NBCK05	NBCK05	NBCK05	NBCK05
Parameter	Units				
1,1-Dichloroethene, SPLP	µg/L				
Acetone, SPLP	µg/L				
Carbon Disulfide, SPLP	µg/L				
Methylene Chloride, SPLP	µg/L				
1,2-Dichloropropane, SPLP	µg/L				
Vinyl acetate, SPLP	µg/L				
Methyl ethyl ketone (2-Butanone), SPLP	µg/L				
1,2-Dichloroethene (total), SPLP	µg/L				
Chloroform, SPLP	µg/L				
1,1,1-Trichloroethane, SPLP	µg/L				
1,1-Dichloroethane, SPLP	µg/L				
Carbon Tetrachloride, SPLP	µg/L				
1,2-Dichloroethane, SPLP	µg/L				
Benzene, SPLP	µg/L				
Trichloroethylene (TCE), SPLP	µg/L				
Bromodichloromethane, SPLP	µg/L				
2-Chloroethyl vinyl ether, SPLP	µg/L				
cis-1,3-Dichloropropene, SPLP	µg/L				
Methyl Isobutyl ketone (4-Methyl-2-pentanone),SPLP	µg/L				
trans-1,3-Dlichloropropene, SPLP	µg/L				
1,1,2-Trichloroethane, SPLP	µg/L				
2-Hexanone, SPLP	µg/L				
Tetrachloroethylene(PCE), SPLP	µg/L				
Dibromochloromethane, SPLP	µg/L				
Chlorobenzene, SPLP	µg/L				
Ethylbenzene, SPLP	µg/L				
Xylenes, Total, SPLP	µg/L				
Styrene, SPLP	µg/L				
Bromoform, SPLP	µg/L				
1,1,2,2-Tetrachloroethane, SPLP	µg/L				

	StationID	K161SB011	K161SB012	K161SB012	K161SB012
	SampleID	161SB01102 (3-5ft)	161CB01201a (0-1ft)	161SB01201a (0-1ft)	161SB01202a (3-5ft)
	DateCollected	11/17/1999	11/17/1999	11/17/1999	11/17/1999
	DateAnalyzed	11/28/99	11/28/99	11/28/99	11/28/99
	SDGNumber	NBCK05	NBCK05	NBCK05	NBCK05
Parameter	Units				
1,1-Dichloroethene, SPLP	µg/L				
Acetone, SPLP	µg/L				
Carbon Disulfide, SPLP	µg/L				
Methylene Chloride, SPLP	µg/L				
1,2-Dichloropropane, SPLP	µg/L				
Vinyl acetate, SPLP	µg/L				
Methyl ethyl ketone (2-Butanone), SPLP	µg/L				
1,2-Dichloroethene (total), SPLP	µg/L				
Chloroform, SPLP	µg/L				
1,1,1-Trichloroethane, SPLP	µg/L				
1,1-Dichloroethane, SPLP	µg/L				
Carbon Tetrachloride, SPLP	µg/L				
1,2-Dichloroethane, SPLP	µg/L				
Benzene, SPLP	µg/L				
Trichloroethylene (TCE), SPLP	µg/L				
Bromodichloromethane, SPLP	µg/L				
2-Chloroethyl vinyl ether, SPLP	µg/L				
cis-1,3-Dichloropropene, SPLP	µg/L				
Methyl Isobutyl ketone (4-Methyl-2-pentanone),SPLP	µg/L				
trans-1,3-Dlichloropropene, SPLP	µg/L				
1,1,2-Trichloroethane, SPLP	µg/L				
2-Hexanone, SPLP	µg/L				
Tetrachloroethylene(PCE), SPLP	µg/L				
Dibromochloromethane, SPLP	µg/L				
Chlorobenzene, SPLP	µg/L				
Ethylbenzene, SPLP	µg/L				
Xylenes, Total, SPLP	µg/L				
Styrene, SPLP	µg/L				
Bromoform, SPLP	µg/L				
1,1,2,2-Tetrachloroethane, SPLP	µg/L				

	StationID	K161SB013	K161SB013
	SampleID	161SB01301a (0-1ft)	161SB01302a (3-5ft)
	DateCollected	11/17/1999	11/17/1999
	DateAnalyzed	11/28/99	11/28/99
	SDGNumber	NBCK05	NBCK05
Parameter	Units		
1,1-Dichloroethene, SPLP	µg/L		
Acetone, SPLP	µg/L		
Carbon Disulfide, SPLP	µg/L		
Methylene Chloride, SPLP	µg/L		
1,2-Dichloropropane, SPLP	µg/L		
Vinyl acetate, SPLP	µg/L		
Methyl ethyl ketone (2-Butanone), SPLP	µg/L		
1,2-Dichloroethene (total), SPLP	µg/L		
Chloroform, SPLP	µg/L		
1,1,1-Trichloroethane, SPLP	µg/L		
1,1-Dichloroethane, SPLP	µg/L		
Carbon Tetrachloride, SPLP	µg/L		
1,2-Dichloroethane, SPLP	µg/L		
Benzene, SPLP	µg/L		
Trichloroethylene (TCE), SPLP	µg/L		
Bromodichloromethane, SPLP	µg/L		
2-Chloroethyl vinyl ether, SPLP	µg/L		
cis-1,3-Dichloropropene, SPLP	µg/L		
Methyl Isobutyl ketone (4-Methyl-2-pentanone),SPLP	µg/L		
trans-1,3-Dlichloropropene, SPLP	µg/L		
1,1,2-Trichloroethane, SPLP	µg/L		
2-Hexanone, SPLP	µg/L		
Tetrachloroethylene(PCE), SPLP	µg/L		
Dibromochloromethane, SPLP	µg/L		
Chlorobenzene, SPLP	µg/L		
Ethylbenzene, SPLP	µg/L		
Xylenes, Total, SPLP	µg/L		
Styrene, SPLP	µg/L		
Bromoform, SPLP	µg/L		
1,1,2,2-Tetrachloroethane, SPLP	µg/L		

	StationID	K161SB012		K161SB012		K161SB012		K161SB013	
	SampleID	161CB01201b (0-1ft)		161SB01201b (0-1ft)		161SB01202b (3-5ft)		161SB01301b (0-1ft)	
	DateCollected	11/18/1999		11/18/1999		11/18/1999		11/18/1999	
	DateAnalyzed	12/3/99		12/2/99		12/1/99		12/2/99	
	SDGNumber	41189		41189		41189		41189	
Parameter	Units								
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	ng/kg	7.995	J	8.587	=	1.694	U	9.573	J
1,2,3,4,6,7,8-Heptachlorodibenzofuran	ng/kg	2.627	=	3.048	=	0.6	U	2.636	=
1,2,3,4,7,8,9-Heptachlorodibenzofuran	ng/kg	1.224	U	0.408	U	0.844	U	0.704	U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	ng/kg	1.381	U	2.23	U	4.987	U	1.362	U
1,2,3,4,7,8-Hexachlorodibenzofuran	ng/kg	0.743	U	0.727	J	0.617	U	0.655	J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	ng/kg	0.93	U	1.501	U	3.357	U	0.917	U
1,2,3,6,7,8-Hexachlorodibenzofuran	ng/kg	0.557	U	0.377	U	0.463	U	0.42	U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	ng/kg	1.066	U	1.721	U	3.849	U	1.052	U
1,2,3,7,8,9-Hexachlorodibenzofuran	ng/kg	0.882	U	0.596	U	0.733	U	0.665	U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ng/kg	2.065	U	2.596	U	10.061	U	1.898	U
1,2,3,7,8-Pentachlorodibenzofuran	ng/kg	0.453	U	0.442	U	0.649	U	0.398	U
2,3,4,6,7,8-Hexachlorodibenzofuran	ng/kg	0.652	U	0.44	U	0.541	U	0.491	U
2,3,4,7,8-Pentachlorodibenzofuran	ng/kg	0.458	U	0.446	U	0.656	U	0.402	U
2,3,7,8-Tetrachlorodibenzo-p-dioxin	ng/kg	0.57	U	0.824	J	6.517	U	0.312	U
2,3,7,8-Tetrachlorodibenzofuran	ng/kg	0.522	U	0.317	U	0.753	U	0.258	U
Octachlorodibenzo-p-dioxin	ng/kg	291.691	=	284.736	=	68.94	=	360.697	=
Octachlorodibenzofuran	ng/kg	9.512	=	9.747	=	0.51	U	8.802	=
Total Hepta-Dioxins	ng/kg	0.842	U	17.911	=	1.694	U	0.444	U
Total Hepta-Furans	ng/kg	2.627	=	3.048	=	0.6	U	2.636	=
Total Hexa-Dioxins	ng/kg	0.93	U	1.501	U	3.357	U	0.917	U
Total Hexa-Furans	ng/kg	0.557	U	1.157	=	0.463	U	1.824	=
Total Penta-Dioxins	ng/kg	2.065	U	2.596	U	10.061	U	1.898	U
Total Penta-Furans	ng/kg	0.458	U	0.446	U	0.656	U	1.345	=
Total Tetra-Dioxins	ng/kg	0.57	U	0.359	U	6.517	U	0.312	U
Total Tetra-Furans	ng/kg	0.522	U	0.317	U	0.753	U	0.258	U

	StationID	K161SB013	
	SampleID	161SB01302b (3-5ft)	
	DateCollected	11/18/1999	
	DateAnalyzed	12/2/99	
	SDGNumber	41189	
Parameter	Units		
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	ng/kg	0.396	U
1,2,3,4,6,7,8-Heptachlorodibenzofuran	ng/kg	0.348	U
1,2,3,4,7,8,9-Heptachlorodibenzofuran	ng/kg	0.49	U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	ng/kg	1.456	U
1,2,3,4,7,8-Hexachlorodibenzofuran	ng/kg	0.232	U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	ng/kg	0.981	U
1,2,3,6,7,8-Hexachlorodibenzofuran	ng/kg	0.174	U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	ng/kg	1.124	U
1,2,3,7,8,9-Hexachlorodibenzofuran	ng/kg	0.276	U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ng/kg	1.913	U
1,2,3,7,8-Pentachlorodibenzofuran	ng/kg	0.236	U
2,3,4,6,7,8-Hexachlorodibenzofuran	ng/kg	0.204	U
2,3,4,7,8-Pentachlorodibenzofuran	ng/kg	0.238	U
2,3,7,8-Tetrachlorodibenzo-p-dioxin	ng/kg	0.246	U
2,3,7,8-Tetrachlorodibenzofuran	ng/kg	0.303	U
Octachlorodibenzo-p-dioxin	ng/kg	27.402	=
Octachlorodibenzofuran	ng/kg	0.422	U
Total Hepta-Dioxins	ng/kg	0.396	U
Total Hepta-Furans	ng/kg	0.348	U
Total Hexa-Dioxins	ng/kg	0.981	U
Total Hexa-Furans	ng/kg	0.174	U
Total Penta-Dioxins	ng/kg	1.913	U
Total Penta-Furans	ng/kg	0.238	U
Total Tetra-Dioxins	ng/kg	0.246	U
Total Tetra-Furans	ng/kg	0.303	U

	StationID	K161GW001	
	SampleID	161GW00106	
	DateCollected	12/07/1999	
	DateAnalyzed	12/15/99	
	SDGNumber	NBCK12	
Parameter	Units		
Chloromethane	µg/L	10	U
Vinyl chloride	µg/L	10	U
Bromomethane	µg/L	10	U
Chloroethane	µg/L	10	U
1,1-Dichloroethene	µg/L	5	U
Acetone	µg/L	50	U
Carbon Disulfide	µg/L	5	U
Methylene Chloride	µg/L	5	U
1,1-Dichloroethane	µg/L	5	U
Vinyl acetate	µg/L	10	U
Methyl ethyl ketone (2-Butanone)	µg/L	25	U
1,2-Dichloroethene (total)	µg/L	5	U
Chloroform	µg/L	5	U
1,1,1-Trichloroethane	µg/L	5	U
Carbon Tetrachloride	µg/L	5	U
1,2-Dichloroethane	µg/L	5	U
Benzene	µg/L	5	U
Trichloroethylene (TCE)	µg/L	5	U
1,2-Dichloropropane	µg/L	5	U
Bromodichloromethane	µg/L	5	U
2-Chloroethyl vinyl ether	µg/L	50	U
cis-1,3-Dichloropropene	µg/L	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	µg/L	25	U
Toluene	µg/L	5	U
trans-1,3-Dichloropropene	µg/L	5	U
1,1,2-Trichloroethane	µg/L	5	U
2-Hexanone	µg/L	25	U
Tetrachloroethylene (PCE)	µg/L	5	U
Dibromochloromethane	µg/L	5	U
Chlorobenzene	µg/L	5	U
Ethylbenzene	µg/L	5	U
Xylenes, Total	µg/L	10	U
Styrene	µg/L	5	U
Bromoform	µg/L	5	U
1,1,2,2-Tetrachloroethane	µg/L	5	U

	StationID	K161GW001		K161GW001		K161GW001	
	SampleID	161GW00106		161GW001F5		161GW001U5	
	DateCollected	12/07/1999		01/19/1999		01/19/1999	
	DateAnalyzed	12/15/99		1/26/99		1/26/99	
	SDGNumber	41368		37130		37130	
Parameter	Units						
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	pg/L	22.734	U	4.089	U	4.92	U
1,2,3,4,6,7,8-Heptachlorodibenzofuran	pg/L	12.101	U	1.824	U	2.822	U
1,2,3,4,7,8,9-Heptachlorodibenzofuran	pg/L	17.043	U	2.435	U	3.768	U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	pg/L	22.383	U	4.145	U	4.13	U
1,2,3,4,7,8-Hexachlorodibenzofuran	pg/L	10.774	U	2.865	U	1.962	U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	pg/L	15.07	U	2.315	U	2.307	U
1,2,3,6,7,8-Hexachlorodibenzofuran	pg/L	8.08	U	1.91	U	1.308	U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	pg/L	17.275	U	2.75	U	2.74	U
1,2,3,7,8,9-Hexachlorodibenzofuran	pg/L	12.792	U	3.116	U	2.134	U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	pg/L	17.844	U	2.95	U	3.258	U
1,2,3,7,8-Pentachlorodibenzofuran	pg/L	11.197	U	2.111	U	2.156	U
2,3,4,6,7,8-Hexachlorodibenzofuran	pg/L	9.448	U	2.797	U	1.915	U
2,3,4,7,8-Pentachlorodibenzofuran	pg/L	11.321	U	2.204	U	2.251	U
2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/L	12.637	U	3.727	U	4.121	U
2,3,7,8-Tetrachlorodibenzofuran	pg/L	11.746	U	3.183	U	3.928	U
Octachlorodibenzo-p-dioxin	pg/L	15.082	U	3.065	U	3.273	U
Octachlorodibenzofuran	pg/L	17.843	U	4.512	U	3.116	U
Total Hepta-Dioxins	pg/L	22.734	U	4.089	U	4.92	U
Total Hepta-Furans	pg/L	12.101	U	1.824	U	2.822	U
Total Hexa-Dioxins	pg/L	15.07	U	2.315	U	2.307	U
Total Hexa-Furans	pg/L	8.08	U	1.91	U	1.308	U
Total Penta-Dioxins	pg/L	17.844	U	2.95	U	3.258	U
Total Penta-Furans	pg/L	11.321	U	2.204	U	2.251	U
Total Tetra-Dioxins	pg/L	12.637	U	3.727	U	4.121	U
Total Tetra-Furans	pg/L	11.746	U	3.183	U	3.928	U

	StationID	K161GW001	
	SampleID	161GW00105	
	DateCollected	01/19/1999	
	DateAnalyzed	1/25/99	
	SDGNumber	37130	
Parameter	Units		
Total Suspended Solids (TSS)	mg/L	4	U

Appendix C

Appendix C is provided in .pdf format on the CDROM provided in the front pocket of this notebook. It contains data validation reports from the sampling subsequent to the Revision 0 Zone K RFI Report.

Appendix D

	StationID	K161VP0010		K161VP0010		K161VP0010		K161VP0010	
	SampleID	161VP001010		161VP001010LR		161VP001015		161VP001015LR	
	DateCollected	04/27/2001		04/27/2001		04/27/2001		04/27/2001	
	DateAnalyzed	5/7/01		5/7/01		5/7/01		5/8/01	
	SDGNumber	41560		41560		41560		41560	
Parameter	**Units**								
Dibenz(a,j)acridine	µg/L	5	UJ	25	R	5	U	100	R
Vinyl chloride	µg/L	10	U	50	R	10	U	200	R
Bromomethane	µg/L	10	U	50	R	10	U	200	R
Chloroethane	µg/L	10	U	50	R	10	U	200	R
1,1-Dichloroethene	µg/L	5	U	25	R	5	U	100	R
Acetone	µg/L	10	U	50	R	10	U	200	R
Carbon Disulfide	µg/L	5	U	25	R	5	U	100	R
Methylene Chloride	µg/L	5	U	25	R	5	U	100	R
trans-1,2-Dichloroethene	µg/L	5	U	25	R	0.64	J	100	R
1,1-Dichloroethane	µg/L	5	U	25	R	5	U	100	R
Vinyl acetate	µg/L	10	U	50	R	10	U	200	R
Methyl ethyl ketone (2-Butanone)	µg/L	10	U	50	R	10	U	200	R
cis-1,2-Dichloroethylene	µg/L	5.6	=	5.7	R	21.9	=	22.1	R
1,2-Dichloroethene (total)	µg/L	5.6	=	5.7	R	22.6	=	22.1	R
Chloroform	µg/L	5	U	25	R	5	U	100	R
1,1,1-Trichloroethane	µg/L	5	UJ	25	R	5	UJ	100	R
Carbon Tetrachloride	µg/L	5	UJ	25	R	5	UJ	100	R
1,2-Dichloroethane	µg/L	5	UJ	25	R	5	UJ	100	R
Benzene	µg/L	0.15	J	25	R	0.39	J	100	R
Trichloroethylene (TCE)	µg/L	203	R	207	=	451	R	700	=
1,2-Dichloropropane	µg/L	5	U	25	R	5	U	100	R
Bromodichloromethane	µg/L	5	U	25	R	5	UJ	100	R
2-Chloroethyl vinyl ether	µg/L	10	UJ	50	R	10	UJ	200	R
cis-1,3-Dichloropropene	µg/L	5	U	25	R	5	U	100	R
Methyl isobutyl ketone (4-Methyl-2-pentanone)	µg/L	10	U	50	R	10	U	200	R
Toluene	µg/L	5	U	25	R	5	U	100	R
trans-1,3-Dichloropropene	µg/L	5	U	25	R	5	U	100	R
1,1,2-Trichloroethane	µg/L	5	U	25	R	5	U	100	R
2-Hexanone	µg/L	10	U	50	R	10	U	200	R
Tetrachloroethylene (PCE)	µg/L	5	UJ	25	R	5	UJ	100	R
Chlorobenzene	µg/L	5	U	25	R	5	U	100	R
Ethylbenzene	µg/L	5	U	25	R	5	U	100	R
m+p Xylene	µg/L	5	U	25	R	5	U	100	R
o-Xylene	µg/L	5	UJ	25	R	5	U	100	R
Xylenes, Total	µg/L	5	U	25	R	5	UJ	100	R
Styrene	µg/L	5	U	25	R	5	U	100	R
Bromoform	µg/L	5	U	25	R	5	U	100	R
1,1,2,2-Tetrachloroethane	µg/L	5	U	25	R	5	U	100	R

	StationID	K161VP0010		K161VP0010		K161VP0010		K161VP0010	
	SampleID	161VP001020		161VP001020LR		161VP001025		161VP00105	
	DateCollected	04/27/2001		04/27/2001		04/27/2001		04/27/2001	
	DateAnalyzed	5/7/01		5/8/01		5/7/01		5/7/01	
	SDGNumber	41560		41560		41560		41560	
Parameter	Units								
Dibenz(a,j)acridine	µg/L	5	U	50	R	5	U	5	U
Vinyl chloride	µg/L	10	U	100	R	10	U	10	U
Bromomethane	µg/L	10	U	100	R	10	U	10	U
Chloroethane	µg/L	10	U	100	R	10	U	10	U
1,1-Dichloroethene	µg/L	5	U	50	R	5	U	5	U
Acetone	µg/L	10	U	100	R	10	U	10	U
Carbon Disulfide	µg/L	5	U	50	R	5	U	5	U
Methylene Chloride	µg/L	5	U	50	R	5	U	5	U
trans-1,2-Dichloroethene	µg/L	0.72	J	50	R	5	U	5	U
1,1-Dichloroethane	µg/L	5	U	50	R	5	U	5	U
Vinyl acetate	µg/L	10	U	100	R	10	U	10	U
Methyl ethyl ketone (2-Butanone)	µg/L	10	U	100	R	0.86	J	10	U
cis-1,2-Dichloroethylene	µg/L	15.9	=	15.9	R	10.8	=	0.69	J
1,2-Dichloroethene (total)	µg/L	16.6	=	15.9	R	10.8	=	0.69	J
Chloroform	µg/L	5	U	50	R	5	U	5	U
1,1,1-Trichloroethane	µg/L	5	UJ	50	R	5	UJ	5	UJ
Carbon Tetrachloride	µg/L	5	UJ	50	R	5	UJ	5	UJ
1,2-Dichloroethane	µg/L	5	UJ	50	R	5	UJ	5	UJ
Benzene	µg/L	0.18	J	50	R	0.68	J	5	U
Trichloroethylene (TCE)	µg/L	288	R	316	=	73.5	=	32	=
1,2-Dichloropropane	µg/L	5	U	50	R	5	U	5	U
Bromodichloromethane	µg/L	5	UJ	50	R	5	UJ	5	UJ
2-Chloroethyl vinyl ether	µg/L	10	U	100	R	10	UJ	10	UJ
cis-1,3-Dichloropropene	µg/L	5	U	50	R	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	µg/L	10	UJ	100	R	10	U	10	U
Toluene	µg/L	5	U	50	R	5	U	5	U
trans-1,3-Dichloropropene	µg/L	5	U	50	R	5	U	5	U
1,1,2-Trichloroethane	µg/L	5	U	50	R	5	U	5	U
2-Hexanone	µg/L	10	U	100	R	10	U	10	U
Tetrachloroethylene (PCE)	µg/L	5	UJ	50	R	5	UJ	5	UJ
Chlorobenzene	µg/L	5	U	50	R	5	U	5	U
Ethylbenzene	µg/L	5	U	50	R	5	U	5	U
m+p Xylene	µg/L	5	U	50	R	5	U	5	U
o-Xylene	µg/L	5	U	50	R	5	U	5	U
Xylenes, Total	µg/L	5	UJ	50	R	5	UJ	5	UJ
Styrene	µg/L	5	U	50	R	5	U	5	U
Bromoform	µg/L	5	U	50	R	5	U	5	U
1,1,2,2-Tetrachloroethane	µg/L	5	U	50	R	5	U	5	U

	StationID	K161VP0020		K161VP0020		K161VP0020		K161VP0020	
	SampleID	161VP002010		161VP002015		161VP002020		161VP002020LR	
	DateCollected	04/27/2001		04/27/2001		04/27/2001		04/27/2001	
	DateAnalyzed	5/7/01		5/7/01		5/7/01		5/8/01	
	SDGNumber	41560		41560		41560		41560	
Parameter	Units								
Dibenz(a,j)acridine	µg/L	5	U	5	U	5	U	50	R
Vinyl chloride	µg/L	10	U	10	U	10	U	100	R
Bromomethane	µg/L	10	U	10	U	10	U	100	R
Chloroethane	µg/L	10	U	10	U	10	U	100	R
1,1-Dichloroethene	µg/L	5	U	5	U	5	U	50	R
Acetone	µg/L	10	U	10	U	10	U	100	R
Carbon Disulfide	µg/L	5	U	5	U	5	U	50	R
Methylene Chloride	µg/L	5	U	5	U	5	U	7	R
trans-1,2-Dichloroethene	µg/L	5	U	5	U	1	J	50	R
1,1-Dichloroethane	µg/L	5	U	5	U	5	U	50	R
Vinyl acetate	µg/L	10	U	10	U	10	U	100	R
Methyl ethyl ketone (2-Butanone)	µg/L	10	U	10	U	10	U	100	R
cis-1,2-Dichloroethylene	µg/L	0.21	J	2.9	J	19.8	=	18.9	R
1,2-Dichloroethene (total)	µg/L	0.21	J	2.9	J	20.8	=	18.9	R
Chloroform	µg/L	5	U	5	U	5	U	50	R
1,1,1-Trichloroethane	µg/L	5	UJ	5	UJ	5	UJ	50	R
Carbon Tetrachloride	µg/L	5	UJ	5	UJ	5	UJ	50	R
1,2-Dichloroethane	µg/L	5	UJ	5	UJ	5	UJ	50	R
Benzene	µg/L	5	U	5	U	0.25	J	50	R
Trichloroethylene (TCE)	µg/L	5.4	=	89.6	=	317	R	354	=
1,2-Dichloropropane	µg/L	5	U	5	U	5	U	50	R
Bromodichloromethane	µg/L	5	UJ	5	UJ	5	UJ	50	R
2-Chloroethyl vinyl ether	µg/L	10	UJ	10	UJ	10	UJ	100	R
cis-1,3-Dichloropropene	µg/L	5	U	5	U	5	U	50	R
Methyl isobutyl ketone (4-Methyl-2-pentanone)	µg/L	10	U	10	U	10	U	100	R
Toluene	µg/L	5	U	5	U	5	U	50	R
trans-1,3-Dichloropropene	µg/L	5	U	5	U	5	U	50	R
1,1,2-Trichloroethane	µg/L	5	U	5	U	5	U	50	R
2-Hexanone	µg/L	10	U	10	U	10	U	100	R
Tetrachloroethylene (PCE)	µg/L	5	UJ	5	UJ	5	UJ	50	R
Chlorobenzene	µg/L	0.58	J	0.48	J	5	U	50	R
Ethylbenzene	µg/L	5	U	5	U	5	U	50	R
m+p Xylene	µg/L	5	U	5	U	5	U	50	R
o-Xylene	µg/L	5	U	5	U	5	U	50	R
Xylenes, Total	µg/L	5	UJ	5	UJ	5	UJ	50	R
Styrene	µg/L	5	U	5	U	5	U	50	R
Bromoform	µg/L	5	U	5	U	5	U	50	R
1,1,2,2-Tetrachloroethane	µg/L	5	U	5	U	5	U	50	R

	StationID	K161VP0020		K161VP0020		K161VP0030		K161VP0030	
	SampleID	161VP002025		161VP002045		161VP003010		161VP003015	
	DateCollected	04/27/2001		04/27/2001		04/27/2001		04/27/2001	
	DateAnalyzed	5/7/01		5/7/01		5/7/01		5/7/01	
	SDGNumber	41560		41560		41560		41560	
Parameter	Units								
Dibenz(a,j)acridine	µg/L	5	U	5	U	5	U	5	U
Vinyl chloride	µg/L	10	U	3.6	J	10	U	10	U
Bromomethane	µg/L	10	U	10	U	10	U	10	U
Chloroethane	µg/L	10	U	10	U	10	U	10	U
1,1-Dichloroethene	µg/L	5	U	5	U	5	U	5	U
Acetone	µg/L	10	U	10	U	10	UJ	10	U
Carbon Disulfide	µg/L	5	U	5	U	5	UJ	5	U
Methylene Chloride	µg/L	5	U	5	U	5	U	5	U
trans-1,2-Dichloroethene	µg/L	5	U	5	U	5	U	5	U
1,1-Dichloroethane	µg/L	5	U	5	U	5	U	5	U
Vinyl acetate	µg/L	10	U	10	U	10	UJ	10	U
Methyl ethyl ketone (2-Butanone)	µg/L	2	J	10	U	10	UJ	10	U
cis-1,2-Dichloroethylene	µg/L	24.5	=	17	=	0.47	J	0.79	J
1,2-Dichloroethene (total)	µg/L	24.5	=	17	=	0.47	J	0.79	J
Chloroform	µg/L	5	U	5	U	5	U	5	U
1,1,1-Trichloroethane	µg/L	5	UJ	5	UJ	5	UJ	5	UJ
Carbon Tetrachloride	µg/L	5	UJ	5	UJ	5	UJ	5	UJ
1,2-Dichloroethane	µg/L	5	UJ	5	UJ	5	UJ	5	UJ
Benzene	µg/L	3.1	J	5	U	5	U	5	U
Trichloroethylene (TCE)	µg/L	94.2	=	8.1	=	5.6	=	10	=
1,2-Dichloropropane	µg/L	5	U	5	U	5	U	5	U
Bromodichloromethane	µg/L	5	UJ	5	UJ	5	UJ	5	UJ
2-Chloroethyl vinyl ether	µg/L	10	UJ	10	UJ	10	R	10	UJ
cis-1,3-Dichloropropene	µg/L	5	U	5	U	5	U	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	µg/L	10	U	10	U	10	U	10	U
Toluene	µg/L	1.4	J	5	U	5	U	5	U
trans-1,3-Dichloropropene	µg/L	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	µg/L	5	U	5	U	5	U	5	U
2-Hexanone	µg/L	10	U	10	U	10	UJ	10	U
Tetrachloroethylene (PCE)	µg/L	5	UJ	1.4	J	5	UJ	5	UJ
Chlorobenzene	µg/L	5	U	5	U	5	U	5	U
Ethylbenzene	µg/L	5	U	5	U	5	U	5	U
m+p Xylene	µg/L	5	U	5	U	5	U	5	U
o-Xylene	µg/L	0.24	J	5	U	5	UJ	5	U
Xylenes, Total	µg/L	0.24	J	5	UJ	5	UJ	5	UJ
Styrene	µg/L	5	U	5	U	5	U	5	U
Bromoform	µg/L	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	µg/L	5	U	5	U	5	U	5	U

	StationID	K161VP0030		K161VP0030		K161VP0030		K161VP0030	
	SampleID	161VP003020		161VP003020LR		161VP003025		161VP003025LR	
	DateCollected	04/27/2001		04/27/2001		04/27/2001		04/27/2001	
	DateAnalyzed	5/7/01		5/8/01		5/7/01		5/8/01	
	SDGNumber	41560		41560		41560		41560	
Parameter	Units								
Dibenz(a,j)acridine	µg/L	5	U	50	R	5	U	25	R
Vinyl chloride	µg/L	10	U	100	R	10	U	50	R
Bromomethane	µg/L	10	U	100	R	10	U	50	R
Chloroethane	µg/L	10	U	100	R	10	U	50	R
1,1-Dichloroethene	µg/L	5	U	50	R	5	U	25	R
Acetone	µg/L	10	U	100	R	10	U	50	R
Carbon Disulfide	µg/L	5	U	50	R	5	U	25	R
Methylene Chloride	µg/L	5	U	6.9	R	5	U	4.7	R
trans-1,2-Dichloroethene	µg/L	0.91	J	50	R	5	U	25	R
1,1-Dichloroethane	µg/L	5	U	50	R	5	U	25	R
Vinyl acetate	µg/L	10	U	100	R	10	U	50	R
Methyl ethyl ketone (2-Butanone)	µg/L	10	U	100	R	10	U	50	R
cis-1,2-Dichloroethylene	µg/L	40.4	=	43.9	R	30.3	=	26.5	R
1,2-Dichloroethene (total)	µg/L	41.4	=	43.9	R	30.3	=	26.5	R
Chloroform	µg/L	5	U	50	R	5	U	25	R
1,1,1-Trichloroethane	µg/L	5	UJ	50	R	5	UJ	25	R
Carbon Tetrachloride	µg/L	5	UJ	50	R	5	UJ	25	R
1,2-Dichloroethane	µg/L	5	UJ	50	R	5	UJ	25	R
Benzene	µg/L	0.26	J	50	R	1.2	J	3.4	R
Trichloroethylene (TCE)	µg/L	278	R	325	=	115	R	93.2	=
1,2-Dichloropropane	µg/L	5	U	50	R	5	U	25	R
Bromodichloromethane	µg/L	5	UJ	50	R	5	UJ	25	R
2-Chloroethyl vinyl ether	µg/L	10	UJ	100	R	10	UJ	50	R
cis-1,3-Dichloropropene	µg/L	5	U	50	R	5	U	25	R
Methyl isobutyl ketone (4-Methyl-2-pentanone)	µg/L	10	U	100	R	10	U	50	R
Toluene	µg/L	5	U	50	R	5	U	1.6	R
trans-1,3-Dichloropropene	µg/L	5	U	50	R	5	U	25	R
1,1,2-Trichloroethane	µg/L	5	U	50	R	5	U	25	R
2-Hexanone	µg/L	10	U	100	R	10	U	50	R
Tetrachloroethylene (PCE)	µg/L	5	UJ	50	R	5	UJ	25	R
Chlorobenzene	µg/L	5	U	50	R	5	U	25	R
Ethylbenzene	µg/L	5	U	50	R	5	U	25	R
m+p Xylene	µg/L	5	U	50	R	5	U	25	R
o-Xylene	µg/L	5	U	50	R	5	U	25	R
Xylenes, Total	µg/L	5	UJ	50	R	5	UJ	25	R
Styrene	µg/L	5	U	50	R	5	U	25	R
Bromoform	µg/L	5	U	50	R	5	U	25	R
1,1,2,2-Tetrachloroethane	µg/L	5	U	50	R	5	U	25	R

	StationID	K161VP0030	
	SampleID	161VP00305	
	DateCollected	04/27/2001	
	DateAnalyzed	5/7/01	
	SDGNumber	41560	
Parameter	Units		
Dibenz(a,j)acridine	µg/L	5	U
Vinyl chloride	µg/L	1.6	J
Bromomethane	µg/L	10	U
Chloroethane	µg/L	10	U
1,1-Dichloroethene	µg/L	5	U
Acetone	µg/L	10	U
Carbon Disulfide	µg/L	5	U
Methylene Chloride	µg/L	5	U
trans-1,2-Dichloroethene	µg/L	5	U
1,1-Dichloroethane	µg/L	5	U
Vinyl acetate	µg/L	10	U
Methyl ethyl ketone (2-Butanone)	µg/L	10	U
cis-1,2-Dichloroethylene	µg/L	6	=
1,2-Dichloroethene (total)	µg/L	6	=
Chloroform	µg/L	5	U
1,1,1-Trichloroethane	µg/L	5	UJ
Carbon Tetrachloride	µg/L	5	UJ
1,2-Dichloroethane	µg/L	5	UJ
Benzene	µg/L	0.18	J
Trichloroethylene (TCE)	µg/L	1.2	J
1,2-Dichloropropane	µg/L	5	U
Bromodichloromethane	µg/L	5	UJ
2-Chloroethyl vinyl ether	µg/L	10	UJ
cis-1,3-Dichloropropene	µg/L	5	U
Methyl isobutyl ketone (4-Methyl-2-pentanone)	µg/L	10	U
Toluene	µg/L	5	U
trans-1,3-Dichloropropene	µg/L	5	U
1,1,2-Trichloroethane	µg/L	5	U
2-Hexanone	µg/L	10	U
Tetrachloroethylene (PCE)	µg/L	5	UJ
Chlorobenzene	µg/L	5	U
Ethylbenzene	µg/L	5	U
m+p Xylene	µg/L	5	U
o-Xylene	µg/L	5	U
Xylenes, Total	µg/L	5	UJ
Styrene	µg/L	5	U
Bromoform	µg/L	5	U
1,1,2,2-Tetrachloroethane	µg/L	5	U

Appendix E

Data Validation Summary for Charleston Naval Complex – Zone K SWMU 161

TO: Jim Edens/CH2M HILL/GNV

FROM: Herb Kelly/CH2M HILL/GNV

DATE: June 26, 2001

The purpose of this memorandum is to present the results of the data validation process for the groundwater samples collected at the Charleston Naval Complex, Zone K, SWMU 161. Each area reviewed and the findings are documented within each subsection that follows. This data was validated for compliance with the analytical method requirements. This process also included a review of the data to assess the accuracy, precision, and completeness following procedures described in the EPA guidance document *National Functional Guidelines for Data Review* (EPA, October 1999). Quality assurance/quality control (QA/QC) summary forms and data reports were reviewed.

A total of 18 groundwater samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for SW-846 8260 analysis - Volatile Organic Compounds (VOCs) by Gas Chromatography/Mass Spectrometry (GC/MS). Included in this number were one equipment blank sample, one trip blank sample, and two additional aliquots for a matrix spike/matrix spike duplicate set.

Sample results that were not within the acceptance limits were appended with a qualifying flag, which consisted of a single- or double-letter code that indicated a possible problem with the data. The qualifying flags originated during the data review and validation processes. These also include the secondary, or the two-digit "sub-qualifier" flags. The secondary qualifiers provide the reasoning behind the assignment of a qualifier flag to the data. The secondary qualifiers are presented and defined in Table 4. The following primary flags were used to qualify the data:

- **U** Undetected. Samples were analyzed for this analyte, but it was not detected above the method detection limit (MDL) or instrument detection limit (IDL).
- **UJ** Detection limit estimated. Samples were analyzed for this analyte, but the results were qualified as not detected. The result is estimated.
- **J** Estimated. The analyte was present, but the reported value may not be accurate or precise.
- **R** Rejected. The data are unusable. (NOTE: Analyte/compound may or may not be present.)
- = Detected. Target parameter detected at the concentration reported.

Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data validation process.

- Holding Times – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- Blank samples – Laboratory method blanks, equipment blanks, and trip blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- Surrogates – Surrogates are added to each sample and are used to monitor lab performance and possible matrix interference.
- Lab Control Sample (LCS) – This sample is a "controlled matrix", either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- Field Duplicate Samples – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- GC/MS Tuning – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- Initial Calibration – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.
- Continuing Calibration – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- Internal Standards – The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.

Groundwater - VOC Analyses

The QA/QC parameters for VOC analyses for all of the samples were within acceptable control limits, except as noted below:

Blank Samples – Selected compounds were reported in associated laboratory, equipment and field blank samples, as listed in Table 1.

TABLE 1
Blank Contamination: VOCs
Charleston Naval Complex, Zone K, SWMU 161

Lab Sample ID	Sample ID	Sample Type	Parameter	Lab Result	Units	Flag Concentrations below listed value
VBLK02	VBLK01	LB	METHYLENE CHLORIDE	0.95	ug/L	9.5
41560001	161EP001L2	EB	ACETONE	2.2	ug/L	22
41560001	161EP001L2	EB	METHYLENE CHLORIDE	0.69	ug/L	0.006.96
41560001	161EP001L2	EB	CHLOROFORM	0.7	ug/L	3.5
41560002	161tP001L2	TB	ACETONE	1.9	ug/L	19
41560002	161tP001L2	TB	METHYLENE CHLORIDE	0.76	ug/L	7.6
41560002	161tP001L2	TB	CHLOROFORM	1.1	ug/L	5.5
41560002	161tP001L2	TB	TOLUENE	0.23	ug/L	1.2
41560002	161tP001L2	TB	DIBROMOCHLOROMETHANE	0.24	ug/L	1.2

If a target parameter determined to be a common contaminant was reported in a field sample, and the concentration was below the level determined to be due to blank contamination, the following actions were taken:

- If the concentration was above the reporting limit, the numeric result was unchanged, but it was flagged "U", as undetected.
- If the concentration was below the reporting limit, the numeric result was changed to the value of the reporting limit, and it was flagged "U", as undetected.

Surrogates - The recoveries for Dibromofluoromethane in the majority of samples ranged from 78 to 85 percent. However, only five samples reflected recoveries of 78 and 79 percent, which were slightly below the requested QC limits of 80 – 120 percent. As all other surrogate recoveries were within acceptable limits, no qualifiers were applied due to these recoveries.

MS/MSD and LCS Samples - All surrogate, matrix spike (MS), matrix spike duplicate (MSD), laboratory control spike (LCS), and laboratory control spike duplicate (LCSD) recoveries were within acceptable quality control limits, except as noted in Table 2. Flags were applied as noted.

TABLE 2
MS/MSD and LCS Recoveries Out of QC Limits: VOCs
Charleston Naval Complex, Zone K, SWMU 161

Sample ID	Parameter	Recovery	Recovery Limits	Associated Samples
MS/MSD #15 - 161VP003010	CHLOROETHANE	60/59	70-130	41560-15 – Flagged detects "J", non-detects "UJ" in sample #15 only.
	ACETONE	30/30		
	CARBON DISULFIDE	67/69		
	VINYL ACETATE	63/63		
	1,1,1-TRICHLOROETHANE	69/71		
	CARBON TETRACHLORIDE	64/66		
	1,2-DICHLOROETHANE	66/67		
	2-BUTANONE	39/39		
	O-XYLENE	69/71		
	2-HEXANONE	51/51		
	TETRACHLOROETHYLENE	68/69		
	2-CHLOROETHYLVINYL ETHER	0/0		Flagged "R"
VBLK01LCS	CARBON TETRACHLORIDE	65	70-130	#1 –18 - Flagged detects "J", non-detects "UJ
	2-CHLOROETHYLVINYL ETHER	54		
VBLK01LCS	CARBON TETRACHLORIDE	69		12DL, 17DL, 18DL - Flagged detects "J", non-detects "UJ
	2-CHLOROETHYLVINYL ETHER	69		

Continuing Calibrations – The responses for selected compounds in the continuing calibration standards varied from those in the initial calibration curve. The compounds are listed in Table 3. Flags were applied to the compounds in the associated samples with a percent Difference of greater than 20 percent in the following manner:

- When the percent difference (%D) was low in the continuing calibration standards, detected compounds were flagged "J" and non-detected compounds were flagged "UJ", as estimated.
- When the percent difference was high in the continuing calibration standards, detected compounds were flagged "J", as estimated. Non-detected compounds were not flagged.

TABLE 3

Exceptions to Continuing Calibration Criteria: VOCs
Charleston Naval Complex, Zone K, SWMU 161

Instrument/Calibration Date	Analyte	% Difference	Associated Samples
VOA1-CCAL-5/07 0838	Xylenes (total)	25.7 low	41560 – 1-18
	Acetone	20.4 high	
	Carbon Tetrachloride	31,4 low	
	1,1,1-Trichloroethane	25.3 low	
	1,2-Dichloroethane	23.9	
	2-Chloroethyl vinyl ether	30.8 low	
	Bromochloromethane	20.1 low	
	Tetrachloroethylene	24.4 low	

Dilutions - Several samples, 161VP001010, 161HP001010, 161VP001015, 161VP001020, 161VP002020, 161VP003020 and 161VP003025, were analyzed at dilutions, due to the high concentration of Trichloroethylene detected. The results for all parameters from the lowest dilution were used, except for the Trichloroethylene exceeding the calibration range. The results for Trichloroethylene exceeding the calibration range in the initial analysis were then reported from the diluted analysis. Therefore, the parameters that were not used in the original or diluted analyses, were qualified "R", as rejected, as there can only be one valid result for each parameter per sample.

Sample Identifications – The sample identifications as reported by the laboratory differ slightly from the identifications as listed on the Chain-of-Custody. An additional "0" was included in the sample identification as listed on the sample container labels, and the laboratory reported this sample identification.

Conclusion

Data qualifiers were applied in the VOC analyses of the groundwater samples, with respect to the quality control parameters as discussed above.

The data can be used in the project decision-making process, as qualified.

Table 4 - Secondary Data Validation Qualifiers

Code	Definition
2S	Second Source
BL	Blank
BS	Blank Spike/LCS
CC	Continuing Calibration
DL	Dilution
FD	Field Duplicate
HT	Holding Time
IB	In-Between (metals - B's → J's)
IC	Initial Calibration
IS	Internal Standard
LD	Lab Duplicate
MD	MS/MSD or LCS/LCSD Precision
MS	Matrix Spike/Matrix Spike Duplicate
OT	Other (see DV worksheet)
PD	Pesticide Degradation
PS	Post Spike
RE	Re-extraction/Re-analysis
SD	Serial Dilution
SS	Spiked Surrogate
TN	Tune

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Charleston, South Carolina 29417
(843) 556-8171

CHAIN OF CUSTODY RECORD

Page 1 of 2

415607.

Client Name/Facility Name: Charleston Naval Complex

Collected by/Company: CH2M Hill / David Gates

SAMPLE ANALYSIS REQUIRED (x) - use remarks area to specify specific compounds or methods

Use F or P in the boxes to indicate whether sample was filtered and/or preserved

Report Data Level III

SAMPLE ID	DATE	TIME	WELL	SOIL	COMP	GRAB	# OF CONTAINERS	pH, conductivity	TOC/DOC	TOX	Chloride, Fluoride, Sulfide	Nitrite/Nitrate	VOC - Specify Method required	METALS - specify	Pesticide	Herbicide	Total Phenol	Acid Extractables	B/N Extractables	PCB's	Cyanide	Coliform - specify type			Remarks
[redacted]	4/27/01	0930	✓				3						8260												EB-13MAR01
[redacted]	4/27/01	0930	✓				3																		TRIP BLANK
[redacted]	4/27/01	0916	✓				3																		
[redacted]	4/27/01	0933	✓				3																		
[redacted]	4/27/01	—	✓				3																		
[redacted]	4/27/01	0945	✓				3																		
[redacted]	4/27/01	1600	✓				3																		
[redacted]	4/27/01	1120	✓				2																		
[redacted]	4/27/01	1152	✓				3																		
[redacted]	4/27/01	1200	✓				3																		
[redacted]	4/27/01	1210	✓				3																		
[redacted]	4/27/01	1216	✓				3																		
[redacted]	4/27/01	1235	✓				3																		

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:
[signature]	5/1/01	1710					
Relinquished by:	Date:	Time:	Received by lab by:	Date:	Time:	Remarks:	
			[signature]	5/1/01	17:00	Results to Cindy Hudson/CH2M 225 E. Robinson St., Orlando, FL 32801 407-423-0800	

White = sample collector Yellow = file Pink = with report

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Charleston, South Carolina 29407
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Charleston, South Carolina 29417
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CHAIN OF CUSTODY RECORD

Client Name/Facility Name: Charleston Naval Complex
Collected by/Company: Chizm Hill / Darryl Gatlin

Use P or P in the boxes to indicate whether sample was filtered and/or preserved
Project Data Level III

SAMPLE ID	DATE	TIME	WELL	SOIL	COMP	GRAB	# OF CONTAINERS	pH, conductivity	TOC/DOC	TOX	Chloride, Fluoride, Sulfide	Nitrite/Nitrate	VOC - Specify Method required	METALS - specify	Pesticide	Herbicide	Total Phenol	Acid Extractables	B/N Extractables	PCB's	Cyanide	Coliform - specify type			Remarks
[redacted]	11/27/01	1153	✓				3						8260												
[redacted]	11/27/01	1503	✓				3																		
IHIVP0031015	11/27/01	1503	✓				3																		MS
IHIVP0031050	11/27/01	1503	✓				3																		MSD
[redacted]	11/27/01	1516	✓				3																		
[redacted]	11/27/01	1526	✓				3																		
[redacted]	11/27/01	1543	✓				3																		

SAMPLE ANALYSIS REQUIRED (x) - use remarks area to specify specific compounds or methods

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:
[signature]	5/01/01	1700	[signature]				
Relinquished by:	Date:	Time:	Received by lab by:	Date:	Time:	Remarks:	
			Patricia Dauer	5/1/01	17:00		

White = sample collector Yellow = file Pink = with report

Data Review and Validation for: GC/MS Volatiles

Project Name & Task:	CNC	ZONE K SMWU 161	
Project # & Case/SDG:	158814.PM.04	41560	
Methods:	☐ OLM03.2 ☑ SW-846 8260B ☐ EPA 624 ☐ Other:		
Program:	☐ AFCEE ☐ NFESC ☑ Other	**Number of Samples:**	18
Field QC Samples:	EB#1, TB#2, MS/MSD#15.		
Reviewed by & Date:	DAN LUCAS	06-11-01	
Matrix:	☑ Water ☐ Soil ☐ Other	6/11	

Quality Control	Form #	Requirements	Check (If No* checked, see comments)	Flags Applied (see comments)
Data Pkg Complete (DP)	Pkg	All required deliverables in pkg.	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
	COC	All samples on COC reported	☑ OK ☐ No*	☐ Flags Applied
Holding Times (HT)	1	Water 7/14d (unpres/pres)	☑ OK ☐ No*	☐ Flags Applied
	COC	Soil 14d (low)	☐ OK ☐ No*	☐ Flags Applied
		Soil (med/high)	☐ OK ☐ No*	☐ Flags Applied
Surrogates (SS)	2	Method surrogates used	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
		Recovery Limits: ☐ Lab ☑ Meth	☐ OK ☑ No* ☐ Diluted out	
MS/MSD or MS/LD	3	Matrix Spikes Provided	☑ MS/MSD ☐ MS/LD ☐ None*	☑ Flags Applied
		Correct Spike Used	☑ OK ☐ No*	
		Acceptance Limits: ☐ Lab ☑ Meth	☐ OK ☑ No* ☐ Diluted out	
LCS (BS) ☑ LCS only ☐ LCS/LCSD	3	LCS per prep. batch	☑ OK ☐ No*	☑ Flags Applied
		Acceptance criteria met	☐ OK ☑ No*	
Blanks (MB,TB,EB, FB/AB)	1	Detects (> MDL or RL/CRQL)	☐ All ND ☑ see blnk wksht	☑ Flags Applied
Method/Lab Blank (MB)	5	Meth Blnk per 12 hr shift	☑ OK ☐ No*	
Tune - BFB (TN) prior to sample analysis	5	Initial & Begin of 12-hr shift	☑ OK ☐ No*	☐ Flags Applied
		Mass Assignment Correct	☑ OK ☐ No*	
		Ion Abundance Criteria met	☑ OK ☐ No*	
Initial Calibration (IC)	6	Minimum of 5 levels	☑ OK ☐ No*	☐ Flags Applied
		Linearity criteria met	☑ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☑ OK ☐ No* ☐ see cal wksht	
Continuing Calib. Verif. (CC) prior to sample analysis	7	Analyzed at begin of 12-hr shift	☑ OK ☐ No*	☑ Flags Applied
		%diff or %drift criteria met	☐ OK ☑ No* ☑ see cal wksht	
		Minimum RRF criteria met	☑ OK ☐ No* ☐ see cal wksht	
	8	Int. Std. RT/Area criteria met	☑ OK ☐ No*	
Internal Standards (IS)	8	Sample IS area criteria met	☑ OK ☐ No*	☐ Flags Applied
Sample Evaluation	1	All hits within cal. Range	☑ OK ☐ No* ☐ All ND	☐ Flags Applied
	5	Samples w/in 12-hr clock	☑ OK ☐ No*	
	raw	Manual Integration performed	☑ No ☐ see comments	
Field Duplicate (FD)	1	Precision of native vs Field Dup	☐ OK ☐ No* ☑ N/A	☐ Flags Applied

This sheet is applicable to multiple methods. All requirement items may not apply to every analytical method.

Case Narrative Comments: CVS, MS/MSD, HT, Sample P+I, dilutions

QC Item	Comments
	Note: TB and EB had detects.
SS	See worksheet.
MS/MSD	See worksheet.
LCS	See worksheet.
MB	See worksheet.

Data Review and Validation for: GC/MS Volatiles

Project Name & Task:	CNC	ZONE K SMWU 161	
Project # & Case/SDG:	158814.PM.04	41560	
Methods:	☐ OLM03.2 ☑ SW-846 8260B ☐ EPA 624 ☐ Other:		
Program:	☐ AFCEE ☐ NFESC ☑ Other	**Number of Samples:**	18
Field QC Samples:	EB #1, TB #2, MS/MSD #15		
Reviewed by & Date:	DAN Lucas	06-11-01	
Matrix:	☑ Water ☐ Soil ☐ Other		

CC See worksheet.

Data Review & Validation - Surrogate, MS/MSD, LCS, or LCS/LCSD Worksheet

Case/SDG: 41560 Matrix: ☑ Water ☐ Soil ☐ Other

Reviewed by DAN LUCAS Date: 06-11-01

Parameter	Recovery	Recovery Limits	RPD	RPD Limits	Associated Samples
Dibromofluoromethane	80 %	~~86%~~ → ~~118%~~	80-120		VBLK01
	80 %				#1
	79 %				#2
	80 %				#3
	79 %				#4
	79 %				#5
	80 %				#6
	80 %				#7
	80 %				#8
	80 %				#9
	80 %				#10
	79 %				#11
	80 %				#12
	80 %				#13
	79 %				#14
	80 %				#15
	80 %				#16
	80 %				#17
	80 %				#18
	82 %				VBLK02 LCS
	79 %				VBLK02
	81 %				#4DL
	80 %				#5DL
	80 %				#6DL
	79 %				#7DL
	80 %				VBLK03 LCS
	80 %				VBLK03

Comments: No flags applied for Dibromofluoromethane surrogate recoveries below the lower acceptable recovery limit. Low Dibromofluoromethane recoveries are a result of a decrease in response from the RRF and indicated in the RFSO. The actual decreases were 14.0%, [redacted] 18.4%, and 19.9% in the RFSO over three analysis days.

Data Review & Validation - Surrogate, MS/MSD, LCS, or LCS/LCSD Worksheet

Case/SDG:	41560	Matrix:	☑ Water ☐ Soil ☐ Other
Reviewed by	DAN LUCAS	Date:	06-11-01

Parameter	Recovery	Recovery Limits	RPD	RPD Limits	Associated Samples
Dibromofluoromethane	78%	~~86%~~ → 118%	80-120		#12DL
↓	78%	↓			#17DL
	79%				#18DL
	84%				#15 MS
↓	85%	↓			#15 MSD
MS/MSD #15					
Chloromethane	60.2 | 59.0%	70% → 130%			#15
Acetone	30.2 | 29.6%				
Carbon disulfide	67.2 | 69.2%				
Vinyl Acetate	63.2 | 63.2%				
1,1,1-Trichloroethane	68.8 | 70.8%				
Carbon Tetrachloride	64.0 | 66.4%				
1,2-Dichloroethane	65.8 | 66.6%				
2-Butanone	38.8 | 34.3%				
2-Chloroethyl-Vinyl-ether	0% | 0%				
2-Hexanone	51.2 | 51.2%				
Tetrachloroethylene	67.6 | 68.8%				
O-Xylene	69.2 | 70.6%	↓			
VBLK01LCS 05-07-01					#1-18
Carbon tetrachloride	65%	70% → 130%			
2-Chloro-ethyl-Vinyl-ether	54.4%	↓			
VBLK03LCS 05-08-01					#12DL, #17DL, #18DL,
Carbon Tetrachloride	68.6%	70% → 130%			MS/MSD #15.
2-Chloro-ethyl-Vinyl-ether	69.2%	↓			

Comments: Apply flags "UJ-MS" to non detects and "J-MS" to detects for sample #15 only - Flag all samples "UJ-~~MS~~, BS" for non-detects and "J-~~MS~~, BS" detects on Carbon tetrachloride. "R-MS" 2-Chloroethylvinylether for #15.
Apply flags "UJ-BS" to non-detects and "J-BS" to detects.
↑ MS ↑ MS

Data Review & Validation Organic Calibration Worksheet

Case/SDG:	41560	**Matrix:**	☑ Water ☐ Soil ☐ Other
Reviewed by	DAN LUCAS	**Date:**	06-11-01

Parameter	A	B	C	D	E	
CC inst: VOA1 05-07-01 08:38	%D					
Xylenes (total)	25.7%	Low				# 1-18
Dichlorodifluoromethane	27.6%	Low	(NT)			
2,2-Dichloropropane	30.3%	Low	(NT)			
Carbon Tetrachloride	34.9%	Low				
1,1,-Dichloropropene	22.0%	Low	(NT)			
1,1,1-Trichloroethane	27.3%	Low				
1,2-Dichloroethane	27.4%	Low				
2-Chloro-ethyl-Vinyl-ether	45.7%	Low				
Bromodichloromethane	22.1%	Low				
Tetrachloroethylene	25.3%	Low				
CC inst: VOA1 05-07-01 21:19	%D					
Xylenes (total)	25.3%	Low				4DL, 5DL,
Dichlorodifluoromethane	27.6%	Low	(NT)			6DL, 7DL.
2,2-Dichloropropane	25.4%	Low	(NT)			
Carbon Tetrachloride	27.2%	Low				
1,2-Dichloroethane	20.3%	Low				
2-Chloro-ethyl-Vinyl-ether	29.7%	Low				
Tetrachloroethylene	25.8%	Low				

Comments:

A: Apply flags "UJ-CC" to non-detects and "J-CC" to detects.

B:

C:

D:

E:

NT = NOT TARGET

Data Review & Validation Organic Calibration Worksheet

Case/SDG:	41560	**Matrix:**	☑ Water ☐ Soil ☐ Other
Reviewed by	DAN LUCAS	**Date:**	06-11-01

Parameter	A	B	C	D	E	
CC inst: VOA1 05-08-01 08:29	%D					
Xylenes (total)	23.5	Low				#12 DL
Dichlorodifluoromethane	31.9	Low	(NT)			#17 DL
Acetone	20.4	High				#18 DL
2,2-Dichloropropane	27.5	Low	(NT)			
Carbon tetrachloride	31.4	Low				
1,1,1-Trichloroethane	25.3	Low				
1,2-Dichloroethane	23.9	Low				
2-Chloro-ethyl-Vinyl-ether	30.8	Low				
Bromodichloromethane	20.1	Low				
Tetrachloroethylene	24.4	Low				

Comments:

A: Apply flags "U5-CC" to non-detects and "J-CC" to detects.

B:

C:

D:

E:

Data Review & Validation Organic Blank Worksheet

Case/SDG:	41560	Matrix:	☑ Water ☐ Soil ☐ Other
Reviewed by	DAN LUCAS	Date:	06-11-01

Target	Water MB	Soil MB	TB (VOC)	EB	FB/AB	x5/x10 ug/L	x5/x10 ug/Kg	Affected Samples
VBLK02 5-09-01								4DL, 5DL,
Methylene Chloride	0.95					9.5		6DL, 7DL
161EP00112 (#1-EB)								
Acetone				2.2		22.0		All samples.
Methylene Chloride				0.69		6.9		
Chloroform				0.70		3.5		
161TP00[redacted] (#2-TB)								
Acetone			1.9			19.0		All samples.
Methylene Chloride			0.76			7.6		
Chloroform			1.1			5.5		
Toluene			0.23			1.2		
Dibromochloromethane			0.24			1.2		

Comments: [redacted], Apply flags "U-BL" non-detects.

Appendix F

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY CHARLESTON NAVAL COMPLEX CHARLESTON, SOUTH CAROLINA CTO-029

RESPONSE TO COMMENTS FOR

DRAFT ZONE K RCRA FACILITY INVESTIGATION REPORT *(Dated December 10, 1997)*

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina

SOUTHDIV Contract Number:
N62467-89-D-0318

Prepared by:

EnSafe Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134
(901) 372-7962

June 11, 1999
Revision: 0

Comment 19:
All site-specific discussions should include the data for all four rounds of groundwater sampling in the final report. The additional data will confirm or refute the presence of contaminants at each individual site.

Response 19:
All four rounds of groundwater data have been included in the revised report.

Comment 20
SWMU 161
Table 10.1.3, page 10.1.5:

- The value for the soil screening level for copper is listed in table 6.4 as 457 mg/Kg. Please correct this value on table 10.1.3 and the number of detections exceeding the soil screening level.

Response 20:
The table has been revised.

Comment 21:
SWMU 162
Section 10.2.2 "Nature and Extent of Contamination", Page 10.2.8:

- This section should correct the text of the "Semivolatiles Organic Compound in Soil" to replace TEQs by BEQs. Additionally, correct the heading of figure 10.2.2.

Response 21:
The heading and text have been revised.

Comment 22:
The ecological risk assessment related to Ecological Subzone K-4, which includes the area of SWMU 162, found that further evaluation is required for the protection of ecological receptors at subzone K-4. This conclusion should be acknowledged in section 10.2.7 "Corrective Measures Considerations" which summarizes risk posed by media and receptors. Please modify this section.

typically evaluated is because report schedules did not allow for the inclusion of multiple rounds of data when the drafts were prepared. The information requested is presented in appropriate places throughout the report and the Navy does not see the value in revising the generic text which is similar to that approved in previous reports.

Comment 13:
Page 9.8, Groundwater Cleanup Goals

- This section references the Zone A RFI Report which states in part "*The CMS will provide information to support the development of cleanup goals. The following information may be required:*

  * *The MCL values if promulgated under the Safe Drinking Water Act.*
  * *Background concentration.*
  * *An alternate standard (i.e., Alternative concentration limit)*

Additional considerations will include the classification and primary use of the contaminated groundwater unit, proposed future uses for groundwater, proximity to surface water, etc".

- The Navy must cleanup groundwater contamination to MCL. If no MCL exists, the Navy must cleanup to the RBC water standard. If no MCL or RBC exists, cleanup levels will be the PQL, natural background, or anthropogenic background as appropriate. Alternate concentration limits (ACLs) can be established in some cases as appropriate under the regulatory requirements of the particular program and/or the Departments regulation (R.61-68) and guidance on groundwater mixing zones. If all requirements are met, ACLs may become the cleanup standards. In addition, technical impracticability may be a consideration and, if so, determination should be made following EPA Directive 9234.2-25. This section of the report should be modified.

Response 13:
The Navy acknowledges SCDHECs position and has revised this section of the Zone A report.

Comment 14:
Page 10.1.3, SWMU 161

- SWMU 161 had one round of soil samples collected from the surface and subsurface at seven sample locations. One duplicate sample was collected and submitted for Appendix IX analysis. The volatiles acetone and 1,2 dichloroethane, a semivolatile di-n-butylphthalate and a dioxin (TCDD TEQ) were all detected in the second interval soil sample. Neither

the text nor the maps show where the detections were. All detections were below their respective CNC screening level and are therefore dropped from consideration. The Navy, however, has not proven these are the maximum values of the contaminants in the subsurface soils. The Navy has not explained the presence of these contaminants in the subsurface soils. Only one sample from the seven locations was submitted for dioxin analysis, dioxins were detected and yet the SWMU is recommended for No Further Action because the sole detection was below the screening values. The presence of these contaminants was confirmed, however the extent has not been examined. Additional assessment is necessary before a CMS decision can be made.

Response 14:

As agreed in previous responses, the revised report will contain hits tables and maps of COCs within the site specific discussion sections. The Navy believes the ubiquitous presence of dioxins in soil at low levels is well documented and does not warrant further assessment. For example, dioxins were detected in all 10 samples collected from the various sites at the annex (including grid locations) with TEQ values ranging from .01 to 11.91 ng/Kg. The TEQ value for the one location sampled for dioxins at SWMU 161 was .46 ng/Kg. By comparison, dioxins were detected in all 32 samples from Clouter Island with TEQ values ranging from .01 to 3.9 ng/Kg. Similar results have been observed in other zones including the sediments from Zone J which would likely be the ultimate sink for this particular contaminant. Continued monitoring for dioxin does not appear substantiated especially when considering the maximum TEQ value observed in any zone has not even exceeded 50% of the suggested EPA cleanup goal of 1 μg/Kg. Also, analytical results from monitoring well 161001 (January 1999) show dioxins were not detected in filtered or unfiltered samples. Per discussions held at the December 1998 project team meeting, the Navy is going to compile the data from all samples analyzed for dioxins, regardless of zone, and perform statistical analyses on the data set so that the project team can make an informed decision regarding whether not more sampling is required.

Additionally, the data presentation will be revised to make better use of the existing information to try to explain the presence of the compounds detected. For example, acetone was detected in 2 subsurface soil samples at concentrations of 7 and 8 μg/Kg respectively. Prior to making any decisions to sample further for this compound the team should consider that acetone was detected in blanks associated with 8 of the 10 sites investigated in Zone K and the grid samples. Even though the detections of 1,2 dichloroethane and di-n-butylphthlate are difficult to explain, the fact remains they were detected in the subsurface at only 1 of 8 locations and neither of these were detected in the numerous groundwater samples collected at SWMUs 161 and 166, in particularly downgradient well, 166016.

Comment 15:
Page 10.1.11, SWMU 161

- SWMU 161 had one monitoring well installed near the oil water separator. The oil water separator was not represented on the site map. One congener of dioxin was detected in the first round of groundwater samples. The remaining three rounds of groundwater samples did not include analysis for dioxin. The presence of this contaminant has been confirmed, however the extent has not been examined. Additional samples are necessary before a CMS decision can be made.

Response 15:
The oil-water separator has been added to the figure. Even though the Navy does not believe dioxins are present in groundwater it is difficult to refute the data from the first round without additional data. The Navy collected an additional sample for dioxin analysis at this site in January 1999. Both a filtered and unfiltered sample were submitted for analysis since it is likely the dioxin detected was a result of suspended sediment in the samples since dioxins are hydrophobic in nature. Dioxin was not detected in either sample.

Comment 16:
Page 10.1.12 Table 10.1.7, SWMU 161

- This table presents a dioxin soil screening level (SSL) for soil to groundwater cross media transport at 950 ng/kg. The maximum concentration detected from the one subsurface soil boring is less than the SSL at 0.46 ng/kg (TCDD TEQ), however the first round groundwater sample from a well eighty feet away is contaminated with dioxin. Subsequent groundwater samples were not analyzed for dioxins. The site specific SSL for dioxin should be recalculated.

Response 16:
The SSLs for the site have been revised and the Navy feels these are protective of groundwater. The collection of the additional sample as described in the previous response provides evidence to defend this position.

Comment 17:
Page 10.2.1, SWMU 162

- The age of the unit and the length of time the unit was in operation should be included in the introductory section.